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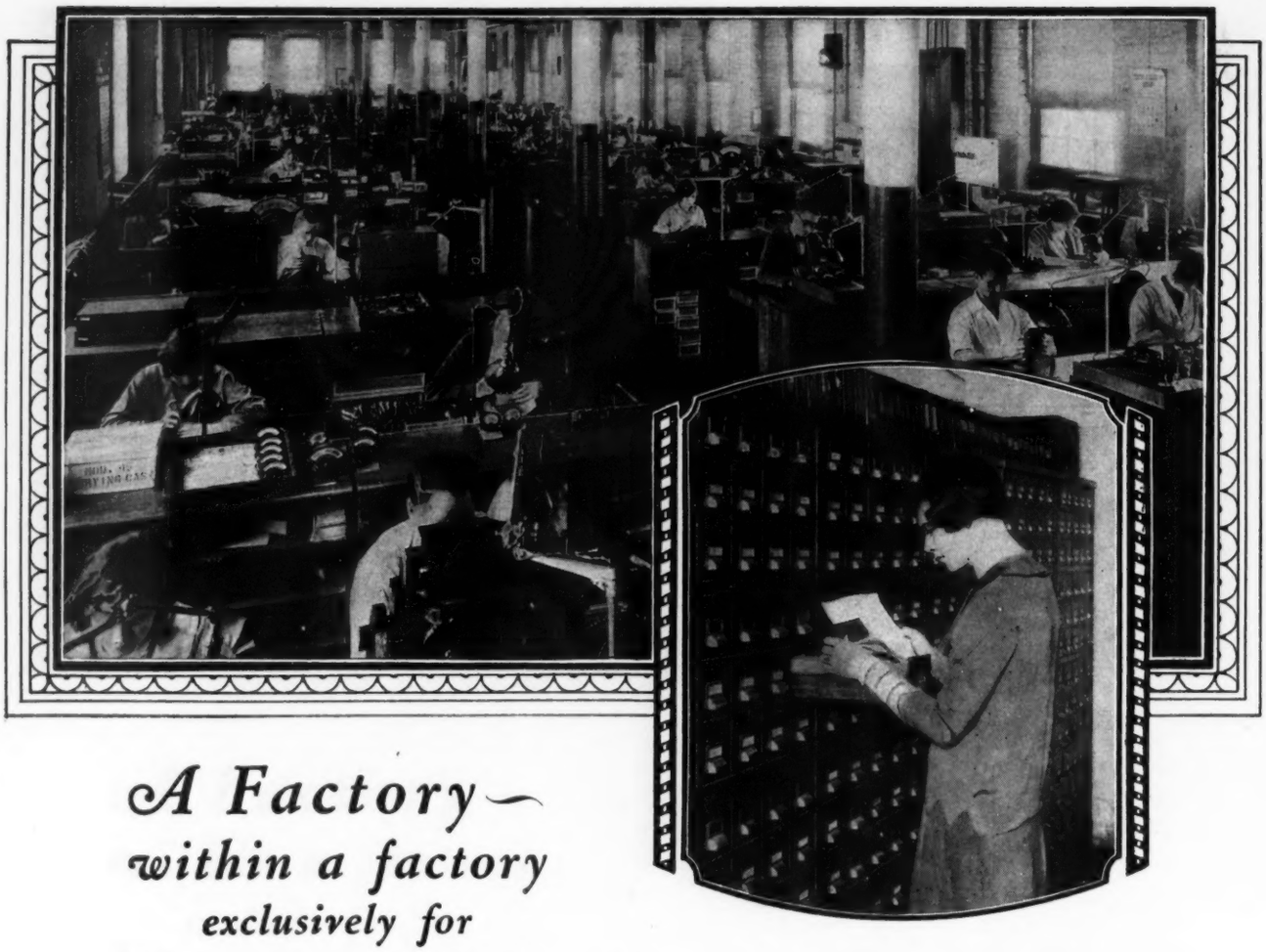

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Editor

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Educate Investors on Merits of Utility Securities

GRADUAL extension of legal investment lists for utility securities suggests an increased obligation on the part of utility executives and the sponsors of new issues to apprize the public of the merits of utility securities as a group. Although the need for publicity of this nature may seem remote in the case of large institutional investors who have consistently urged legalization of these issues, the capital-cost differential favoring other groups such as the rails suggests further education along these lines.

The rapidly growing body of investors may not be fully aware, for example, of the stability of the power industry. They may overlook the fact that labor, a decidedly uncertain factor, plays a relatively minor part. With the railroads and most large industries a decision to strike may throw a successful enterprise into chaos almost over night. Recovery may require weeks or months, and the company's securities will reflect the lowered earning power in the interval. The investor may overlook also the fact that conditions affecting utility earnings in general are of such a nature as to allow for advance provision against unfavorable developments. For power and light companies cost of coal, for example, represents a large proportion of the finished product. Coal price fluctuations might seriously handicap a utility, so the situation is safeguarded in the contract. Rates are built up on the supply of coal, of a specific kind and of a given heat content, and prearrangement is made to adjust them as coal prices fluctuate.

In this and other ways power and light companies are less subject to sudden changes in operating conditions than are most other industries. Freedom from hazard is an investment quality worth capitalizing, and education along these lines will help establish for these securities the market they deserve. This is especially true in view of the rapid growth in the body of new investors.

* * * *

Are We Riding for a Fall?

ALL notable civilizations of former days reached a climax and then crashed to ruins about their builders. As pointed out by Bancroft Gherardi at the Denver meeting of the American Institute of Electrical Engineers, cultural development occurs only when capital piles up to give the necessary leisure. Yet the story of all the ancient civilizations is a story of increase of capital, a consequent increase of culture, and then a crash. Are we going to follow Greece and Rome?

Engineers are largely responsible for our civilization. Their power and machines provide the widely distributed wealth that affords the leisure for cultural development. These contributions imply an obligation to see that their works make for public good and not for public disaster. No other civilization created its wealth through engineering, but this is unimportant, for all fell because of the abuse of wealth and leisure. Their people lacked the stamina to stand prosperity and were an easy prey to ruder peoples disciplined through fighting for the primary necessities of existence.

There is no logic in the statement that history repeats itself. There is no limit to the possibilities for human cultural development or for mankind to use wealth to build a better civilization. So to the engineer, in addition to providing the material means for progress, falls the task of affording social guidance in the use of these tools. This is the larger duty of the engineer in the world of today.

* * * *

Economic Issues Transcend State Lines

IN A RECENT letter to the ELECTRICAL WORLD President Stratton of the Massachusetts Institute of Technology pointed out that the Maine law prohibiting power exportation should be judged by economic standards. This is a note well worth heeding during the presidential campaign wherever politicians give way to the temptation to discuss interstate transmission policies, regulative matters involving two or more commonwealths, and other allied topics.

Politics and economics are, of course, very closely interwoven in the affairs of modern nations, but in the past too many problems affecting the business welfare of states have been attacked primarily from the political instead of from the economic angle. Had the question of surplus power exportation from the Pine Tree State, for example, been treated on its economic merits during the past few years, there is little doubt that the Fernald act would have been repealed or modified sufficiently to enable many millions of dollars to be spent in Maine to develop hydro-electric sites at present representing excessive waste of stream power through lack of local markets for large-scale blocks of energy.

The problems of interstate commerce and its regulation are of enormous importance in a country like the United States, but it would be unfortunate to allow their legal and political aspects to overshadow their economic phases. In the case of Maine the fear of federal control of interstate transmission has been utilized by opponents of power exportation to deter the public from demanding a change in the law. State lines have been made political barriers to hydro-electric development. Some of the best legal and executive minds of the utility industry have been grappling with the problem of securing adequate state regulation of exported power, and it is believed that a workable method has been designed which can be utilized in harmony with the United States Constitution through voluntary submission to commission control on each side of the line, supplemented later, if need be, by delegated authority from the national

government to such commissions. Apparently the way has been cleared for a *prima facie* determination of the issue upon an economic basis as regards the Maine situation, and those who have closely observed the trend of public opinion in that state during the last two years have reason to believe that the time is near when the question will be settled upon its merits.

Throughout the entire country, indeed, there is a growing recognition that economic issues transcend state lines—a belief thoroughly compatible with the most determined opposition to the encroachment of federal control upon state rights.

* * * *

Co-ordinating Sales Policies Under Group Management

WHENEVER an independently managed power company passes under centralized control a period of readjustment may be expected during which local and headquarters policies must be articulated in the interests of unified effort. Sales activities deserve particular consideration because many managers of local properties have never absorbed the broad picture of sales development and discriminating load building which the leaders of industry are today championing. Not a few of these local executives have been too close to the engineering problems of their companies and to their financing and daily operation to realize the commercial needs of today and the years to come. A good deal of resistance must be overcome before adequate progress can be made, and the situation calls for tact, patience and wisdom in its handling. A common basis of action is the recognition at both local and headquarters offices that the prosperity of the subsidiary companies is the objective of all concerned.

One of the chief obstacles which we have observed in the path of commercial development on some properties under the holding-company régime has been the unwillingness of local managers to pay the fair costs of business development allocated to them by the headquarters organization. Responsibilities of local salesmen and their superiors in relation to headquarters co-operation are often set forth in management contracts in a manner which is far from clear.

It ought not to take more than a year to clarify the situation on any property where the resident executives accept the holding company plan in good faith and with open minds. Local companies must accept the fact that money must be expended to develop business in the volume required by present and prospective economic demands. If executives cannot see this after a reasonable time, their commercial tasks will have to be shared with or taken over by men who do see it. The public is not going indefinitely to stand still and take service in any field in small volume or from inadequate installations when through free co-operation between headquarters specialists and local forces the best results known to the electrical art can be offered it. And the time is fast coming when utility stockholders will not be satisfied with less than a vigorous and intensive high-grade development of business. It is too much to expect that the first few weeks or months of centralized management will yield a mutual understanding. But what cannot be launched and steered toward a successful outcome if all concerned resolve to play the co-operative game for all they are worth!

Concentrate Tests on Surges

DEVELOPMENT of new instruments to measure surges on transmission lines resulted at once in many installations being made on utility systems. Data have been contributed from many sources and the errors and possibilities of the measuring devices have been determined. For several reasons none of the data have been conclusive, but all of them offer promise.

At this stage of development it would seem logical to concentrate these measurements on one or two transmission lines. Many measuring devices and skilled test forces are needed to get complete quantitative information. A line in a lightning area should be selected for a series of test data and efforts should be concentrated on this line. Grounded and ungrounded performance, the use of ground wires, the effect of arcing rings or horns as against absence of such devices, the influence of clearances, the effect of height of line, the action of arresters and choke coils, and many other factors, could be investigated one by one, and answers to the problem of protection against lightning and surge would be found. Because of lack of knowledge of these things the industry loses millions of dollars each year. There is an enormous waste in hit-or-miss efforts widely scattered.

Manufacturing and utility companies could well devote the time, the men and the money to this joint research program, for they have a mutual and very large economic interest in finding the facts. A planned co-operative program will save money.

* * * *

Cable Corrosion and Concrete

CONCRETE needs to be cured if it is not to damage lead-covered cable. Many cases of cable corrosion may be traced directly to the chemical action of alkaline hydrates found in green concrete. The remedy for these troubles is to accelerate the curing of concrete by using CO_2 and different construction methods. Many utilities have been accustomed to seal the ends of cable ducts, thus forcing all curing to be done from the outside. A delay of several months in curing may well occur in such cases.

At the Denver meeting of the American Institute of Electrical Engineers D. W. Roper said that accelerated curing could be had readily by leaving the higher level end of a duct open to the air and by using CO_2 in the duct at intervals of about ten days until tests of drainage water showed no trace of alkalinity. The CO_2 under pressure is forced into the duct from the lower level end. For a time tests will show that zero alkalinity results in drainage water, but in a few weeks the curing of the concrete is completed.

This solution of a bad problem in cable corrosion came from research by conference. Utility engineers, cement engineers, communication engineers and chemists met together last winter and discussed all facts contributed by those present. As a result all readily agreed on the cause of cable corrosion in green concrete and the method just described for stopping corrosion was suggested. The result is a technical advance in the art, a saving of many dollars to the industry and an improvement in service reliability.

The Trade Commission *Hearings*

What Have They Accomplished?

FEDERAL TRADE COMMISSION hearings in the investigation of the public utility information bureaus have been suspended for the summer. What has been the result so far? This question is in everybody's mind and, frankly, two conclusions seem inescapable: First, that this kind of an investigation is unfair and a perversion of the public purpose involved; second, that the power industry has been clumsy and careless in its publicity work and has brought this trouble upon itself.

The actual findings of the investigations so far have been quite innocuous. No evidence has been produced that would indict the power industry for either criminal or moral wrongdoing. The issue raised is entirely one of propriety and judgment. It is seen that the utilities have employed the services of press agents on a large scale and these press agents have been crude and boastful, as is often the case. It may be true that other industries employ press agents. So does the government, and the Federal Trade Commission has a press agent of its own. But, considering the semi-public character of the utilities, the point is whether or not there is propriety in this widely organized publicity operation.

AFTER all, it is not unnatural that the public should be critical and suspicious. Within recent memory, on as many occasions, the oil, harvester, packing, insurance, steel and railway industries aroused resentment and each in turn was investigated. Now men hear that the power companies are reaching out into the press, the pulpit, the legislatures and the schools, and they are alarmed. The Senate directed the Federal Trade Commission to seek such evidence. And the commission has set to work to get just what the Senate is asking for.

The hearings are, therefore, an inquisition in which the prosecutor and the judge, by the implication of their questions, are endeavoring to get evidence of improper conduct into the record. What the public wants to know is whether these information bureaus and the power companies have done right or wrong, good work or bad, and why. But the commission is interested only in establishing wrongdoing. One witness, for example, called together the clergy of the state at their request to help them form a ministerial alliance for religious purposes only, but he was permitted to testify only that he had held a meeting of ministers, and it stands on the record with sinister inference. And so it goes. Cross-examination of witnesses is not permitted by the commission's procedure, but the chief counsel will present questions suggested by the power industry. Questions cast to produce evidence creditable to the witness are barred, however, because "the commission is not interested in that." The purpose of the investigation is frankly to produce evidence against the power industry.

What is this evidence? What have the power companies really done? It is not what they have done so much as how they have done it that is counting against them. There was no moral wrong in the hiring of publicity men to tell the story of the power industry and exalt the efficiency of private ownership. But, after they hired these press agents, the power men on the state committees neglected to support and supervise them, and it was inevitable that they should exaggerate and brag and blunder, striving eagerly to magnify their story, their performances and their jobs. The advocates of government ownership too are highly organized and work through the press, pulpit, legislatures and schools. The information bureau men followed their lead.

Again, when it became apparent that the Senate was bent on an investigation, the leaders of the power industry declared that they had nothing to hide and that their books and their files were all open to inspection. This was quite proper and sensible. But at the same time they also set up the Joint Committee of National Utility Associations with an elaborate headquarters in Washington and a sizable war chest. And the public asked itself: If they have done no evil, why this preparation for battle? Now, there was nothing wrong in the Joint Committee nor in the Washington office. And the power companies felt an obligation to protect the investments of their more than a million stockholders, whose property the Senate was about to attack. But to casual observers there was an implication of fear and therefore guilt.

SO FOR four months the commission has been examining men. In the autumn it will resume. It will probably be the first of next year before it drops this publicity theme and begins to probe into the financial and economic aspects of the industry, when the returns from a fifty-two-page questionnaire are in. Meanwhile the public gathers its impression from what it reads in the newspapers, and naturally it reads there what is coming out of the hearings.

The amount of money spent in this promotional work has been small compared with the expenditures of many other interests for similar publicity. But because utility corporations are publicly regulated, people seem to think that though others engage in propaganda, they should not. And people feel that the truth is strong enough without exaggeration, and they wonder if the power men have really made so great a contribution to humanity as they claim they have. And, also, people weary of the complacency and self-praise that the industry has so freely indulged in. For the public admires frank, courageous, signed advertising that presents facts. It is interested in the uses and benefits of electric service to the home and business and industry. It is not interested in endless talk of the achievements and virtues of the utility companies.

Serving Scattered Power Loads

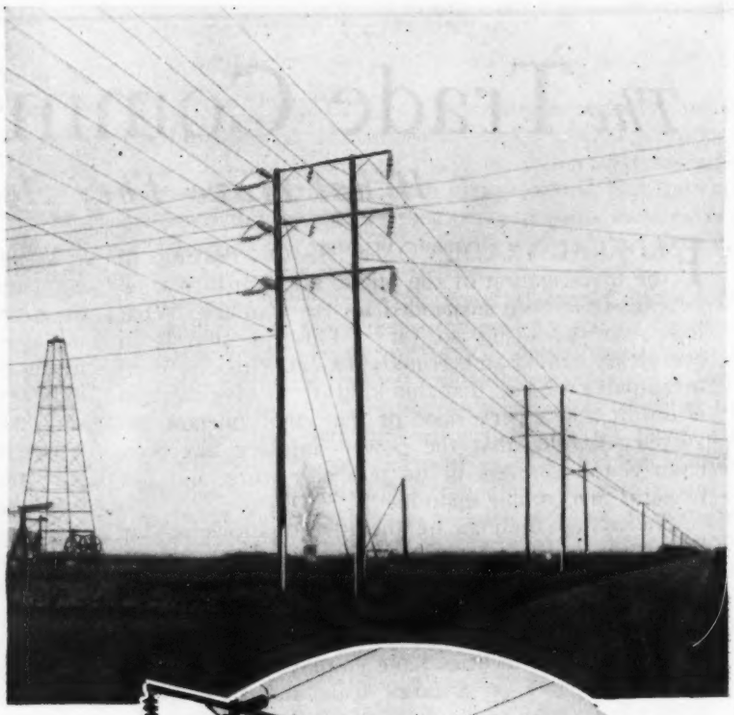
ON ACCOUNT of the extensive development of oil fields in its territory, the Oklahoma Gas & Electric Company has had a remarkable record of growth in the past few years. Five years ago the company had about 400 miles of transmission lines; today it has nearly 2,000. As the pictures show, extensive use has been made of H-frame construction for multiple and single lines, although many of the latter are carried on single poles with steel cross-arms. These are 66-kv. lines.

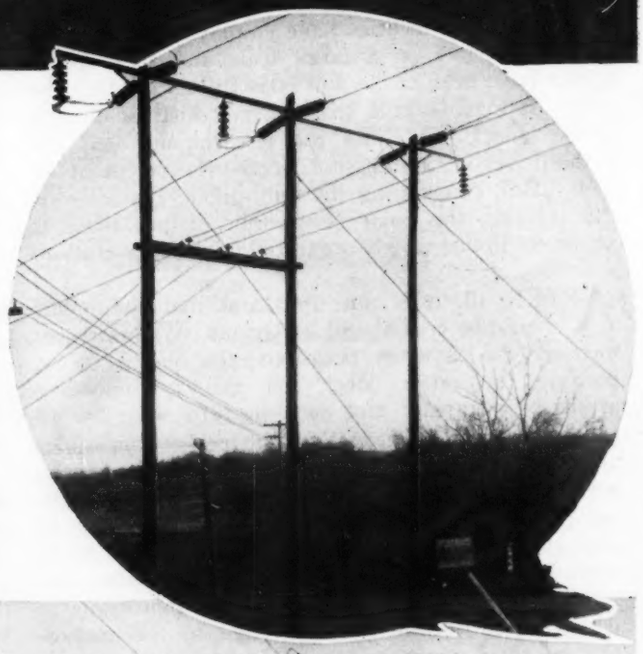
At top—Three-circuit line near Garber—one circuit straight through, the others changing direction.

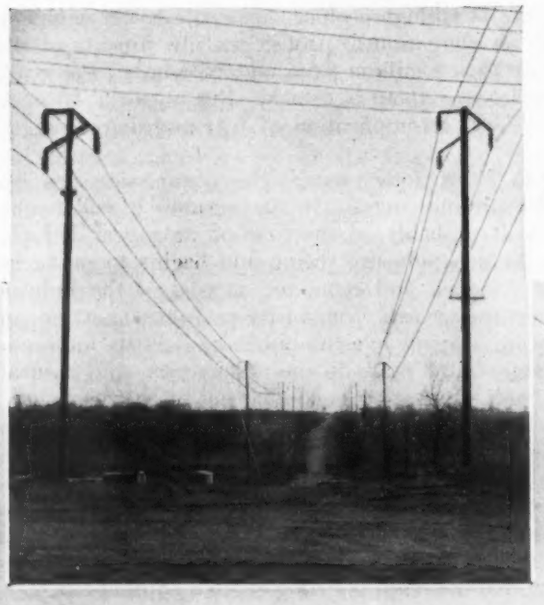
In circle—Three-pole dead-end on Chandler-Drumright line.

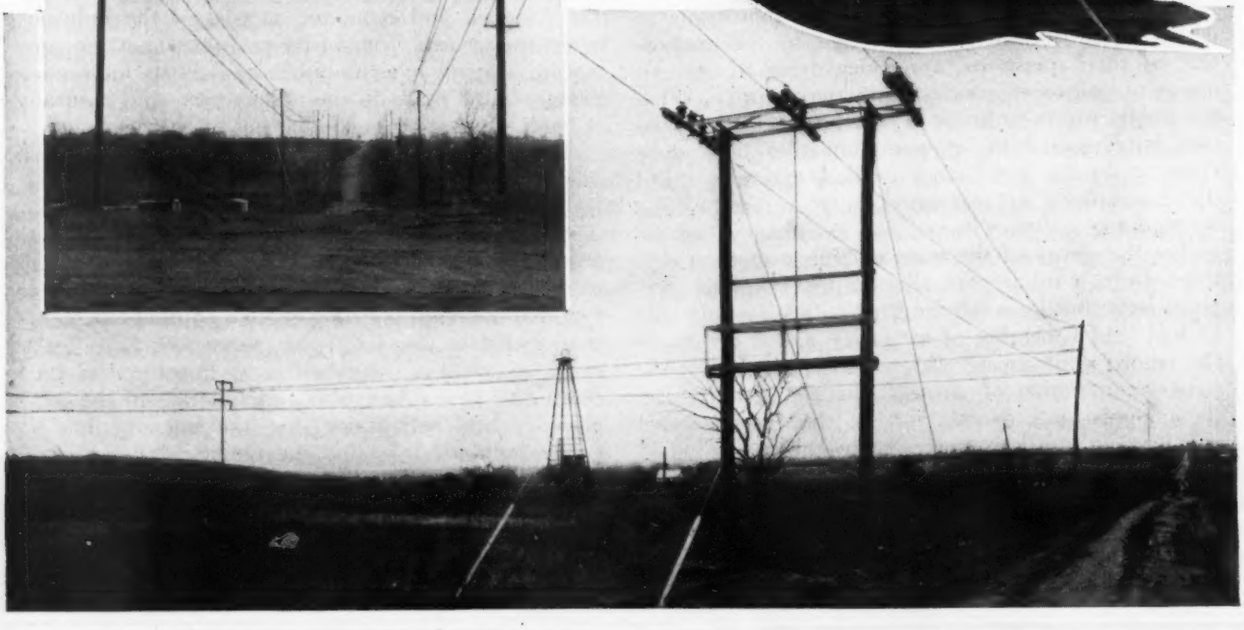
At left—Steel-armed poles leaving substation in Seminole field.

Bottom—Junction of Oklahoma Gas & Electric line with Oklahoma Power Company line west of Weleetka.









Condemns Complexity

Interconnection of stations and systems should permit simplification of arrangements. Effect of tradition is obvious in many stations. Fear of oil breakers reacted on designers. Typical examples of complexity are cited

By M. M. SAMUELS
J. G. White Engineering Corporation, New York

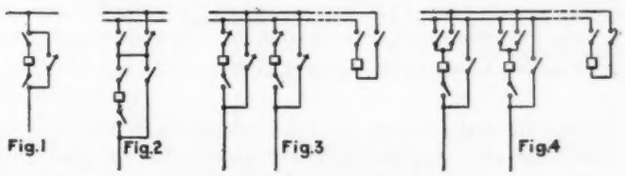
ONE of the foremost reasons which has been justly put forth in favor of large utility interconnections is that these make it possible for each individual plant of a system to reduce the number of its spare units, boilers, lines, etc., because it can depend upon the other plants of the system to supply energy to system loads in case of emergency. It should be expected, of course, that the same argument would hold for switching systems and that these also would become simpler as stations grow in size and are more and more connected.

However, a review of the published descriptions of a great number of recently completed plants, or plants now under construction, representing about 3,000,000 kw. installed and about 9,000,000 kw. probable ultimate capacity, shows, with a few very laudable exceptions, even more complicated switching arrangements than are found in the older stations, even when the necessary complications brought about by large concentrations of energy, such as isolated phases, very large breakers, etc., are taken into consideration. Even single-line diagrams of connections are so complicated that it is difficult for the trained eye to follow them. Mazes of bus structures or outdoor bus work are found surpassing in complication anything ever devised by professors of psychology to study the learning ability of rats or guinea pigs. So-called foolproof devices and interlocks, which sometimes are only proof that their originator is a fool, are found and their abundance would seem to have a tendency actually to make a fool out of the generally quite competent operator. By-passes and transfers are introduced which are so complicated that no sensible operator would dare use them in the excitement of any emergency condition for which they are intended.

ENGINEERS ARE RESPONSIBLE

It is not surprising that those who foot the bill do not revolt against the cost of all these unnecessary complications, because it is very difficult to obtain appreciation for simple designs. They appear to be obvious, calling forth such remarks as, "There is nothing to this, anybody could have done it," whereas more complicated designs, even though the complications may be unnecessary and brought about by incompetence, will call forth awe and admiration. Possibly those who pay the bill are proud of the complicated and intricate stations which they possess. But how about the engineers themselves? Have they all lost sight of the fact that, the Einstein theory notwithstanding, a straight line is still the shortest distance between two points for all practical purposes? Why do the engineers sponsor all these complicated mazes?

The reason possibly lies partly in the fact that many an electrical engineer has retired into the self-complacency of knowing his jx's and the ability to push his slide rule for calculating line drops, even though this work, which no doubt is of very great importance, calls for very little ingenuity and imagination and for a knowledge of mathematics not above the public school grades. This type of engineer does not take interest in acquiring experience in the imaginative and creative work of power station design, considering this work beneath him because it is done in the drafting room. He is not familiar with the tricks of the draftsman's trade, and there are many such tricks, mostly based on the lack of imagination on the part of the average draftsman and his



Figs. 1, 2, 3 and 4—Three objectionable and one sensible by-pass arrangement

Fig. 1—This type of by-pass does not belong in a large power station.
Fig. 2—This connection is hazardous and complicated.
Fig. 3—A "general nuisance connection" which has all the weaknesses of a single bus station.
Fig. 4—A sensible by-pass arrangement for a large station.

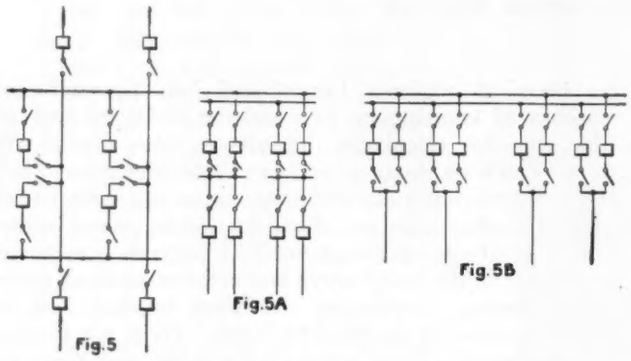
reluctance to make changes. One who is not familiar with these tricks is apt to mistake the neater drawing for the better design, or to be convinced that a new idea would take too long to be worked out, and thus delay construction.

The preliminary designs of a new development should be studied from all angles and every new idea must be carefully considered, even if it appears impractical at first glance, because it often happens that such an idea turns out to be the most practical after careful study. The straight line path between two points is very seldom found at the first attempt; many schemes have to be considered and a great deal of exploration has to be done before the simplest and straightest method is found. Possibly some design complications are brought about by the operating man himself because he happens to have a minor accident fresh in his mind, even though it never happened before and will never happen again. This operator may proceed to have a big station designed with the main idea in mind of preventing a recurrence of such an accident. It should never be forgotten that the only absolutely safe station is one that is not running.

No doubt some of the design complications are caused by mere incompetence on the part of the designer who

takes advantage of the fact that electrical energy will find its way through a circuit, no matter how complicated. Again, a man may be an excellent switchboard designer without knowing the first principles of station design. Some stations are obviously complicated for reasons of tradition. Older utility executives and designers may be suffering from inertia and may be reluctant to change methods which may have been very necessary in the past, but are somewhat antiquated now.

Whatever the causes, the fact remains that many of our big stations are too complicated. It is possible to bring certain features out of the maze which seem to



Figs. 5, 5A, 5B—Complicated switching arrangement and a preferred scheme

Fig. 5—Despite two sets of breakers and two sets of buses, each circuit is out when its breaker is out in this connection. A pair of circuits is out when selectors are operated.
Fig. 5A—Equivalent connection of Fig. 5 to show disadvantages more clearly.
Fig. 5B—A connection preferred to that in Fig. 5.

repeat themselves and to classify them with the expectation that this classification will lead to the simplification of large stations built in the future. The following subdivision would appear to be logical:

A—Diagrammatic Complications.
1. By-passes.
2. Transfers and selectors.

B—Structural Complications.
1. Caused by complicated diagrams.
2. Equipment (principally breaker mechanisms, disconnecting switch mechanisms, and rod interlocks).
3. Arrangement of equipment and circuits.

Both A and B can be subdivided into:
C—Main switching.
D—Auxiliary switching.

The main switching can be subdivided into:
E—Stations supplying load at generator voltage.
F—Stations supplying load over high-tension lines.

The auxiliaries can be subdivided into:
G—Steam plant auxiliaries.
H—Hydro plant auxiliaries.

Typical Complications

It is preferable to discuss diagrammatic complications by referring to diagrams of typical single circuits rather than to complete station diagrams. The single circuit when multiplied by all the circuits of the station results in a very complicated assembly. In the single circuit diagram the most common form of by-pass consists of a disconnecting switch in parallel with an oil breaker (Fig. 1). This form of by-pass is justified in small outlying substations, especially automatic or supervised substations. In such substation the by-pass serves the purpose of periodic breaker inspection, the by-pass being kept in the circuit only long enough to inspect the particular breaker, during which period the circuit is running without protection instead of being out of service. But such a by-pass has no place in power plants on large systems because the system interconnections should make it possible to disconnect any circuit in a power station without interrupting service to any customer.

A degenerated outgrowth of Fig. 1 is shown in Fig. 2. There are five sets of disconnecting switches per circuit and the scheme is actually in use on a very large system. There are so many possibilities of running an important line without protection in this scheme that it must be condemned not only as too complicated but also as very hazardous. If a transfer arrangement is needed on that particular system it could be obtained in the much simpler and safer manner shown in Fig. 4, in which the transfer can be made by means of a spare breaker. This permits always operating a circuit with protection and still maintains two main buses for normal operation, and at the same time uses only four instead of five sets of disconnecting switches per circuit. The rather innocent looking Fig. 2 represents the acme of useless complications as shown in any of the recently published descriptions of large installations.

The connections in Fig. 3, which are quite popular in a number of very expensive installations, may be justly termed "the general nuisance diagram." The diagram appears to represent a system with two sets of buses, but on closer analysis it will be found to contain one bus only, the second bus being not really a bus, but merely a transfer connection which is never able to serve more than one circuit at a time. This scheme, however, when the necessary expenditure is warranted, is quite appropriate for the same purpose as Fig. 1, that is, in unattended substations, having the advantage over Fig. 1 of having always the spare breaker in the circuit during the time in which the regular service breaker is being inspected. But on very expensive stations—and this connection is used on stations costing several millions of dollars each—it is out of place for the reason that it should always be possible on a big system to spare any line long enough to inspect a breaker, and for the further reason that it has the weakness of a single bus station in that a single broken insulator on the bus or on the bus side of a disconnecting switch will put the whole station out of commission. Here, too, the double bus arrangement of Fig. 4 can be had by merely adding one disconnecting switch per circuit.

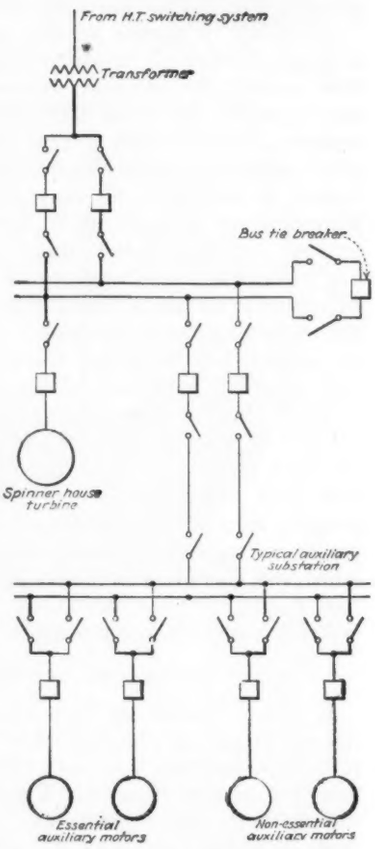
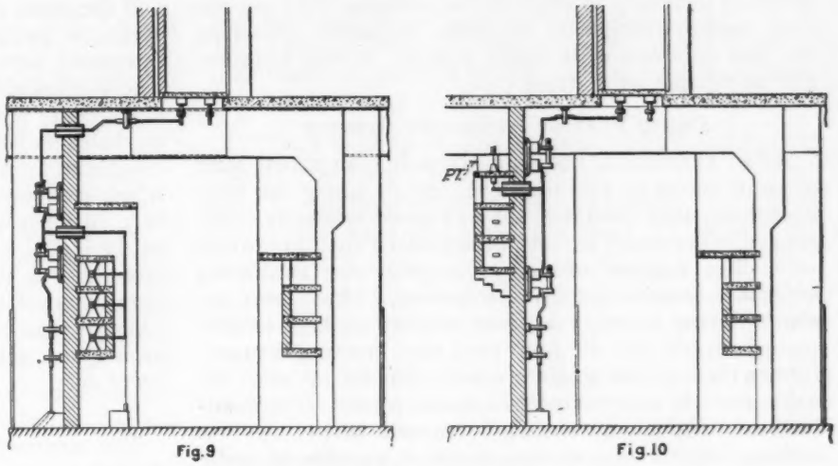
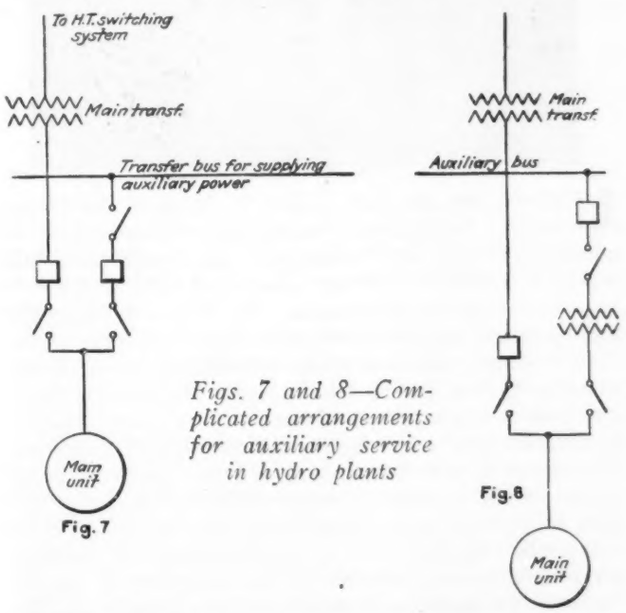


Fig. 6—A good arrangement for serving steam plant auxiliaries

A scheme which is very commonly encountered in some of our largest city stations, and therefore deserves serious consideration, is shown in Fig. 5, with which Fig. 5A is diagrammatically exactly identical, the last figure only having been translated into the diagrammatic vernacular, thus making it somewhat easier to follow. The circuits in plants with this connection are arranged in pairs and require a total of four breakers and six sets of disconnecting switches per pair if the line and ground disconnects are left out of consideration. Two breakers are used as selectors for selecting one of the two buses for the pair of circuits and the other two breakers are used as individual circuit breakers, one in each of the pair of circuits. Thus, in spite of the two sets of buses and the two sets of breakers, each circuit is out of service when its own individual breaker is out, and both circuits of the pair are out of service when the selector breaker is out until the other selector breaker is thrown in. The two individual circuit breakers are in series with the one selector breaker, a feature which is no doubt claimed as the main reason for the scheme, because if one breaker should stick and not open under a short circuit the breaker in series with it would open and clear the circuit even though the other circuit of the pair would also go out in this case. There may be some merit in this argument, but certainly not sufficient thus to equip the great multiplicity of circuits in an important city plant and make the station very complicated. City plants of a normal type are always laid out so that a customer can be supplied not only in two but in many different ways, and not only from more than one power house but from more than one substation. A connection is shown in Fig. 5B which is much simpler, clearer and makes each circuit independently selective from two buses. It is to be preferred for such stations even though it does not quite follow the traditions of some of the older companies.



Figs. 9 and 10—An avoidably complicated structure and its simple equivalent which saves money



Figs. 7 and 8—Complicated arrangements for auxiliary service in hydro plants

All the principal diagrammatic complications of the large stations seem to have one thing in common—a lack of confidence in the oil circuit breaker. Fig. 3, for instance, is an inheritance of the old trolley days when carbon breakers were in the first stages of their development and were not very reliable. A space feeder panel and transfer bus was, therefore, provided, so that any feeder could be thrown on the spare panel by means of the transfer bus, which was equipped with a spare breaker. Fig. 5 is no doubt likewise a tradition that was inherited from the dark ages of primeval electrical development.

Modern oil circuit breakers, in spite of all their shortcomings, are not old carbon breakers. They may now be considered pretty reliable pieces of equipment; on a par, at least, with transformers and generators; more reliable than steam turbines, and certainly more reliable than lines. The greatest number of interruptions is caused by line trouble and a multiplicity of transfer and selector switches will not reduce the interruptions from these causes.

The remark often is heard that the development of oil breakers has not kept up with that of system interconnections and that the magnitude of short circuits on some of the systems is so great that there is no breaker available to take care of it. While it is true that breaker development has lagged behind and that the cost of breakers is much too great in comparison with the cost of other electrical apparatus, it is equally true that breakers are available today capable of taking care of the greatest number of cases. On the other hand, many of the by-pass and transfer devices are so arranged that if a breaker does blow up under a short of, say, 2,000,000 kva. the respective by-pass and transfers would very likely also be damaged. The N.E.L.A. sub-committee having this matter in hand would perform an excellent service if it would initiate an investigation which would bring out some definite statistics showing how many times the various types of by-passes and transfers were actually operated during a period of one year and for what reasons they were operated. It is almost certain that such an investigation would show that many of them are never operated and others are operated at such infrequent intervals as to make their elimination highly advisable.

Another feature of considerable interest which should be investigated is the relation of mechanical to

electrical flexibility in each station, because there are stations having multiplicity of buses, by-passes, transfers, etc., but only one main steam header. A bus is generally as reliable as a steam pipe.

Panic Fear of Auxiliary Service

As to auxiliaries, not only chaos but an actual state of panic seems to prevail. The fear of losing the auxiliaries is partly justified, but to a great extent is exaggerated. The result is that in the panicky rush to provide an endless number of energy supplies for auxiliaries important features are often forgotten. Thus, there are plants having as many as four sources of high-tension energy supply, yet all four feed into one single transformer through one single breaker. Similar necks of the bottle exist in many important steam plants. The availability of motors which can be thrown across the line without any starting devices makes it possible to make the station auxiliary system now much simpler than it could be made a few years ago, because the biggest nuisance was always the kicking out of auxiliaries on low voltage. But motors thrown across the line do not require low-voltage protection, and this feature eliminates this principal nuisance.

If there is any part of the switching system of a big station that should be as simple as possible it is the auxiliary switching. Fig. 6 represents about the best arrangement that can be devised to date for taking care of steam plant auxiliaries. The diagram is quite self-explanatory, but it may be mentioned that the only automatic feature required is a relay system to trip the bus tie breaker in case of trouble on the main supply, thus allowing the spinner turbine to pick up the essential auxiliaries. The spinner turbine, of course, should be equipped with a generator which is capable of taking care of the starting currents of the essential auxiliaries. In some cases it is preferable to use so-called "shaft generators" instead of transformers.

There are a number of hydro stations which have great spaces full of bus and switching structures using a multiplicity of units such as are shown in Figs. 7 and 8 for taking care of the auxiliaries. The important auxiliaries in a hydro station are generally of comparatively low capacity, consisting mainly of oil pumps and water pumps for bearings. The other auxiliaries, such as the crane or gate motors, are operated only at infrequent intervals. It would seem that elaborate bus structures are altogether out of proportion if provided only for taking care of these auxiliaries. The use of the exciter is the best approach to the solution of the problem in many cases, bearing in mind, of course, that in such cases the voltage regulation would have to be on the generator rheostat instead of the exciter rheostat because there may be only one unit running. In other cases "shaft generators" can best solve this problem.

Structural Complications Ensue

The complicated diagram is also the principal cause of structural complications. When it is borne in mind that a dot on a single-line diagram, indicating a tap from a 220-kv. bus, may represent 100,000 to 150,000 cu.ft. of station space it will be seen at once how by-passes and transfers can complicate a station.

Oil circuit breaker mechanisms have undergone great improvements in recent years, but disconnecting switch mechanisms are generally still quite crude. Many stations still use stick-operated disconnects and resort to mechanical interlocks between the breaker mechanisms and the doors of the disconnect compartments. There is really no excuse today for the use of any mechanical interlocks between breakers, or disconnects or doors. The Robinson Cory type of key locks serve the purpose much better and make it possible to eliminate complicated mechanisms which often fail to function. Arrangement complication is a matter of careful and skillful design which it is very difficult to discuss. An example, however, of what is being done and what could be done may not be out of order. Fig. 9 shows an existing bus structure and Fig. 9A shows how the same results could have been obtained with less complication, less tubes, less bus supports, less barriers and less slabs. The new arrangement gives better access to the bus and can be had at a lower cost.

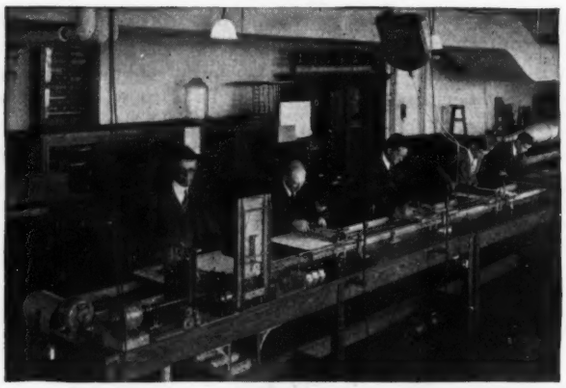
Conclusions

The tendency should be toward the elimination of as many by-passes and transfers as possible. For this purpose statistics should be gathered giving the conditions under which each of these devices was actually operated.

More attention should be given to the design of the physical arrangement of switching and bus work.

The question of hydro plant auxiliaries should be systematically studied and further discussed.

Solves Differential Equations in Few Minutes



UNDER the direction of Dr. V. Bush of the Massachusetts Institute of Technology, a continuously recording machine or "integraph" has lately been built which is capable of solving differential equations involving two successive integrations. By following with pointers equations plotted on movable platens, observers actuate a modified watt-hour meter controlling through a relay a motor-driven pencil which traces the desired result curve on a moving sheet of paper. The second stage of integration is accomplished by a Kelvin integrating wheel. The device is accurate to within 1 to 2 per cent and is useful in the solution of many problems involving variable coefficients, such as those of vacuum tube circuits where the characteristics of vacuum tubes are involved, circuits containing iron where the saturation of the iron destroys the linear relationship between current and flux, circuits involving rectifiers where the resistance of the rectifying element is a function of the current flowing through it, electrical machinery behavior and the study of transient.

The integraph requires from eight minutes to a few hours to make computations which would take an engineer anywhere from a month to a year to work out by ordinary methods.

Load Factor-Equivalent Hour Values Compared

Means of computing loss on line when maximum load and load factor are known

By F. H. Buller and C. A. Woodrow
Central Station Engineering Department
General Electric Company

THE load factor of a system is defined as the ratio of the average power of the system to the maximum power over a certain period of time (say one year). The equivalent hours may be defined as "the average number of hours during which it would be necessary for the peak load to be carried in order to give the same energy loss as that given by the actual load throughout the year." These definitions apply to the "annual load factor" and the "annual equivalent hours." Similar definitions can readily be framed for the daily, weekly and monthly values of these quantities.

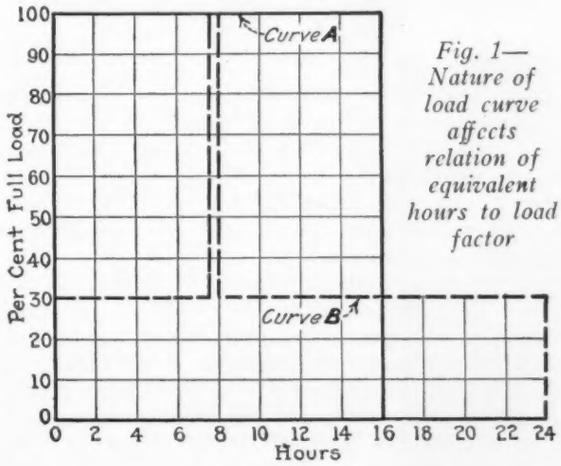


Fig. 1—Nature of load curve affects relation of equivalent hours to load factor

It is apparent from these definitions that the load factor affords a means whereby the capacity of installed equipment may be compared with its output, whereas the equivalent hours give a measure of the annual losses of the system. Also, it is obvious that for any particular load curve there will be a fixed ratio between these two quantities.

The value of this ratio is determined by the load curve. If the curve be of the type shown in Fig. 1 as Curve *B*, where the peak exists for only a short part of the day and the load curve is flat for the remainder of the day, it is apparent that the equivalent hours are proportional to the square of the load factor; whereas if the load is steady for part of the day and zero thereafter, as in Curve *A*, Fig. 1, the equivalent hours are directly proportional to the load factor. These relations are illustrated in Fig. 2, in which Curves *A* and *B* correspond to similarly lettered curves in Fig. 1. For any other type of load curve the relation between load factor and equivalent hours will lie between the two extreme relations cited.*

A series of representative load curves, including curves of central-station loads, industrial loads, railway loads and lighting loads, were taken, and the equivalent hours and load factor are computed for each curve. It was found that the relation between the equivalent hours and load factor as obtained in this way followed very closely the law:

$$\text{Per Cent Equivalent Hours} = 0.7\,(LF)^2 + 0.3\,(LF)$$

Where Per Cent Equivalent Hours

$$= \frac{\text{Average Value of Square of Load}}{\text{Square of Maximum Load}} \times 100$$

and LF = Per Cent Load Factor.

This curve is plotted in Fig. 2 as Curve *C*, and the actual points on which the curve is based are shown also in that figure.

This relation gives a means of computing approximately the loss on a given line or machine over any specified period of time when only the maximum load and the load factor are known, a condition which sometimes arises in the preparation of economic data. These two quantities are usually more readily obtained than the actual load curve or the equivalent hours.

As is apparent from Fig. 2 and from the foregoing discussion, the present study covers a considerable range of practical conditions; but since no data were available on load factors below 30 per cent or above 75 per cent, these portions of the curve should be used with caution. In the case of the lower portion in particular (shown as a broken line) any error in the curve is likely to give rise to a large percentage error in the equivalent hours; and this portion of the curve can therefore be regarded only as a rough approximation to the truth.

Effect of Losses Which Are Independent of Load

The foregoing discussion applies only where the loss is proportional to the square of the load. If there exist iron losses, dielectric losses, windage and friction losses, etc., which are independent of the load, they must be taken into account separately.

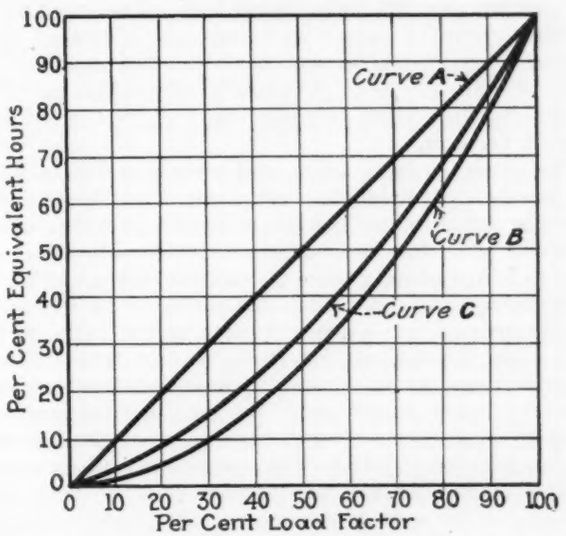


Fig. 2—Equivalent hours bear a relation to load factor ranging between the square and a direct proportion

Let the loss factor be the factor by which the total copper losses at peak load must be multiplied to give the value of the total annual loss, and let there be a loss W_i independent of the load but assumed constant at all times

*These general limits are well known (refer to "Economics of Electrical Distribution" by Reyneau and Seelye, pages 39 to 47).

when the equipment under consideration is in operation. Then

$$\text{Per Cent } W = (KW_i \div W_c) + \text{Per Cent Equivalent Hours}\dagger$$

Where

$$\text{Per Cent } W = \text{Per Cent Loss Factor} = \text{Loss Factor} \div 87.60$$

K = (Total number of hours per year during which constant loss occurs) ÷ 87.60

W_i = Value of constant loss

W_c = Copper loss at peak load

If the additional loss is not constant, but varies from time to time when the equipment is running, as would dielectric loss in a cable operated at a variable temperature, then the quantity KW_i must be evaluated from a known or assumed curve of this loss against time or load. If it is only a small proportion of the total loss, an average figure may be quite accurate enough for economic calculations.

†*The per cent equivalent hours refers only to the copper loss.*

The above formulas give the loss factor as a percentage. To obtain total annual loss, the loss factor as a decimal (i.e., per cent W/100) must be used. If there are no constant losses, Total Annual Loss = (W_c × 8760 × Per Cent Equivalent Hours) ÷ 100. If there are constant losses, Total Annual Loss = (W_c × 8760 × Per Cent W) ÷ 100.

Performance of High-Voltage Lines

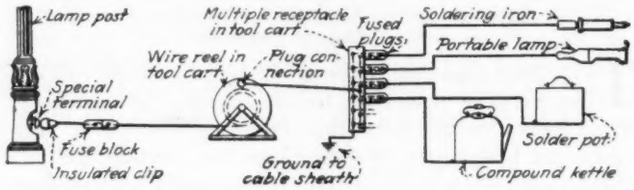
REPORTS on 57 separate lines operating above 100 kv. and totaling 2,239 miles in length show 11.77 interruptions per 100 miles of line, according to the overhead systems committee of the Great Lakes Division, N.E.L.A. The lines reported are situated in Wisconsin, Illinois, Indiana, Ohio and Michigan. About 67 per cent of the causes of interruptions were stated to be lightning, the failures per 100 miles being 7.94. The largest remaining group of causes was listed as "Unknown and Miscellaneous." Accidental grounds and mechanical failures were very few. Practically all troubles were on a single phase; phase-to-phase short circuits were not over 4½ per cent.

The protective value of ground wires was indicated by the number of lightning flashovers, there being 5.89 lightning interruptions per 100 miles of line with ground wire and 12.19 for lines not so protected. The effect of height of lines above ground on susceptibility to lightning disturbances was not clearly demonstrated by the data. The heights of top wires at towers varied from 50 to 90 ft., and it would appear from the data received that this difference in its relation to lightning troubles was offset by other conditions. No conclusive inferences could be drawn from a comparison based on the amount of insulation employed because again other factors outweighed the relatively small differences in flashover strength of the various mountings. Flashover damages reported on lines equipped with arcing horns or rings included burned conductors and damaged insulators in sufficient number to indicate that neither horns nor rings were absolute preventives.

A number of the lines reported were double circuit—one circuit arranged vertically on each side of the tower. An analysis indicated that both lines were interrupted simultaneously in 20 per cent of the cases. Conductors with apparently proper clearances swinging together in high winds were reported in one or two cases.

Electricity Used in Cable Splicing

THE recent development of a successful electric solder pot for field use has led the New York Edison Company to equip several tool carts so that power can be supplied to solder pots, compound kettles, soldering irons, portable lamps and other appliances required for cable



Elements involved to provide electric service to cable splicers

splicing. The current is taken from the nearest lamp post over a 250-ft. flexible cable wound on a reel inside of the tool cart. Also within the tool cart is a terminal board into which may be inserted heavy connection plugs attached to extension cables running to utilization equipment. The main supply and all extension lines are fused at the plug connections.

With this equipment the heating of solder and compound can be carried on within the manholes. If ventilation is required an electrically driven blower can be easily attached. Considerable inconvenience is therefore eliminated. The splicer has his hot solder and hot compound continually within reach, and his frequent calls to the street above for hot material largely disappear. Further improvement in working conditions result from better lighting made practicable by easy connection to an electrical supply circuit. The neatness and lack of

Electric solder pot, compound kettle, soldering iron and portable lamp constitute a great convenience to cable splicers

noise associated with this electrical equipment should be appreciated by the public, especially when cable-jointing operations must be conducted in residential districts at night.

The convenience of the electrically equipped tool cart will undoubtedly encourage the use of other pieces of equipment, such as ordinarily not often used in manhole work.

Looking Back Over the
Trade Commission Hearings

A review of four months of the investigation of the activities of the power industry's public information bureaus

By PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

ONLY the organized public relations activities of public utilities have been dealt with during the four months that the Federal Trade Commission has been engaged in the investigation of that industry in compliance with Senate Resolution No. 83. The investigation has revealed that only a small fraction of 1 per cent of the gross income of the utilities has been expended in the conduct of that work, but it has come in for the most meticulous probing. The testimony taken covers nearly 5,000 typewritten pages. In addition, some 3,700 separate exhibits have been offered in evidence. Many of these exhibits are voluminous and the commission is having difficulty in finding space for their filing.

Federal Trade Commission hearing on public utility publicity activities

Commissioner McCulloch, presiding, sits near the window in the background and Chief Counsel Healy, standing, is questioning the witness seated at the left. In the foreground is the press table. The seats for spectators are not shown.

To many observers it seems that the course being followed is in danger of falling into the same rut of detail which has militated against the effectiveness of certain of the other investigations conducted by the commission. On the other hand, Judge Robert E. Healy, the chief counsel of the commission, is a man of ability, a clear thinker striving for definite objectives. It is entirely probable that the purpose for examining each one of the directors of the state utility information bureaus will be revealed, despite the fact that much of the time seems to be consumed in trying to prove what each is willing to admit. This activity in all of the states was modeled on the plan set up in Illinois, and as a result there was much similarity in the character of the work. Nevertheless, Judge Healy has required practically every one of these directors to go through the same general questioning, which is accompanied by what seems to be much useless identification of papers. When a recess was taken July 6 the commission seemed to be far from the end of this inquiry into public relations activities. It will be resumed in September.

Because of the similarity of testimony a review of the important developments of the first four months of the investigation does not require much space. The hearing has shown that while the amounts of money at the disposition of the state information bureaus are small, it also reveals that they co-operated systematically and have, in effect, built up a very efficient nation-wide organization intended to inform the public of the views and the activities of the utility industry. It is admitted by all who have followed the investigation that no illegal act has been uncovered. At the same time it is admitted that most of the industry's public relations men were overzealous in many instances. It can be said further that the evidence indicated that the executives of the utilities allowed these employees to assume responsibilities which they were not fitted to discharge. Attempts were made to glorify the industry to an extent that was not justified and it certainly violated propriety and good taste. In many cases it is clear that the use of advertising was urged in the expectation that it would help in contacts with the editorial personnel of newspapers. Letters from public relations men in many instances revealed poor judgment and a misconception of their duties. Another impression gained by some of those who have kept in close touch with the testimony is that the campaign for revision of textbooks and for the introduction of supplementary books and pamphlets in the schools went too far. Some disinterested observers are of the opinion that the whole undertaking was a questionable one.

On the other hand, the record is replete with instances

tending to justify practically everything that was done by the National Electric Light Association, by the state information bureaus and by the state utility associations. It shows that when the work started many of the textbooks dealing with public utility matters contained expressions of opinion hostile to the private conduct of the business. Few textbooks dealt adequately with the subject. Some contained glaring errors, while others omitted important fundamental facts, such as the existence of regulatory statutes.

Propaganda in Schools Against Utilities

On behalf of the utilities this is said in one of the statements in the record: "If the utility representatives have been ambitious to broadcast even in the schools and colleges what they believe to be correct information concerning the production and sale of electrical service and to instill what they believe to be correct doctrines in regard to the economics of that service, their work has not been undertaken without cause. In a large measure it has been necessary to offset the activities of professional advocates of the nationalization of industry, whose program usually has been to begin with the public utilities, and of proponents of a, perhaps, milder but quite as devastating an innovation, the deliberate setting up of what is certain to be unfair governmental competition with existing utility service. These influences have had no hesitation in extending their activities to the schools and colleges."

An example of the type of activity which it has been necessary to combat was cited in the form of a report by the executive director of the League for Industrial Democracy, organized in 1905 as the "Intercollegiate Socialist Society" and reorganized under its present name in 1921. The league in reporting on its 1924-1925 activities has the following to say with reference to work in colleges:

"Of the utmost importance in the work of the league has been its college activities. Paul Blanshard, the league's remarkably able field secretary, began his college work in late September in San Diego, Calif., his home, where he spoke before 500 embryo teachers at the assembly at the state teachers' college. His college trip began Oct. 1, with an address at Occidental College, Los Angeles, and from that date until April 21 of this year, a period of nearly ten months, he spoke, with but few exceptions, several times each day before student assemblies, economics and sociology classes, Y.M.C.A., L.I.D., and other student groups, labor unions, women's clubs, church forums and similar organizations. Altogether he addressed 40,000 students in 101 colleges, as compared with 35,000 students in 85 colleges during 1923-24, and in addition many thousands of townspeople."

An Example of Absurd Misstatements

In the record also are numerous references to the statements in textbooks to which objection was made. To cite one example, Ashley's New Civics contains this statement: "It is estimated that in some of our larger cities only one-quarter of the present value of public utility corporations consists in the actual value of their plants, rolling stock and other property. That is, three-quarters of the present market value of their stocks and securities consists of franchises granted to them for little or nothing by our government and is represented in their stock by water."

It was stated on behalf of the utility associations that it was their aim to observe the rule that material furnished for use among teachers or in schools must be utterly free from bias, prejudice and propaganda. There were some instances in which this rule evidently was not followed, but in a statement submitted to the commission at the hearing, just prior to the recess, it was stated that it is the intention of the associations "to enforce this rule in respect to any activities in which they may engage."

Some objection has been made to the limitations which have been placed upon witnesses. It is contended that they have not had ample opportunity to explain collateral circumstances which would have prevented a wrong interpretation of certain questions and answers. Judge Healy denies, however, that he has ever knowingly prevented a witness from discussing matters relevant to the question, and reference to the transcript of the hearing is all that is necessary to establish that many witnesses presented their points of view. But Judge Healy took the position that the commission is not asked to investigate the subject of public ownership, but was instructed to investigate the publicity features that have been used by the utilities to influence public opinion in the matter of public ownership "of the means by which power is developed and electrical energy is generated and distributed." Despite this there has been a good deal said by witnesses to set forth their point of view.

Advertising as an Influence Upon Newspaper Editors

While some of the public relations men were urging the use of advertising for the effect that it might have on their relations with the editorial end of the paper, there is no evidence that this was the prevailing opinion. H. Lee Jones, the director of the Kansas bureau, for instance, testified that editorial opinion that could be bought with advertising was not worth having. The colloquy between Judge Healy and Mr. Jones on that point is of particular interest.

Judge Healy: Have you ever urged upon any of your companies, or has any member of your committee or any utility man in your hearing urged upon the companies that they advertise extensively in the newspapers as a means of securing the good will of the newspaper editors?

Mr. Jones: On the contrary, I have made every possible effort before the members of my bureau, in discussing matters of that kind, to point out to them the desirability of advertising in newspapers and other periodicals for the benefits that accrue from the advertising itself, entirely apart from any editorial consideration whatever. One of my employers once spoke of what in his mind might be the conceivable connection between editorial policy and the advertising columns. I was quick to correct him, because, in my mind, the two should in no instance be confused. Advertising should be engaged in purely for the promotion of the company's product or for the sale of its merchandise, but not in order to influence the newspaper editor. The newspaper editor who can be influenced by advertising to my mind is not the sort of an editor whom I, at least, should want to influence in my behalf.

Judge Healy: Do you think that the advertising by the utilities has influenced editorial attitude in your state?

Mr. Jones: I believe it has not. I can cite several examples where advertising is used very generously, but there has never been any change in editorial attitude.

Because of the necessity for concentrating questioning on the activities that have been criticised, an opportunity has been given the sensational press, and particularly a newspaper chain which has the reputation of being none too careful in the charges and intimations which it makes, to create in the public mind an entirely wrong impression of the work which the utilities have been doing. The competitive situation in the newspaper field is such that even the conservative press associations, apparently

in the fear that they would be charged with favoritism toward the power industry, have been inclined to feature developments which give a distorted picture of what has been brought out at the hearings. Then too, the constructive efforts, which constituted most of the work on behalf of the utilities, naturally do not provide the unusual which stands out as news.

The conjuring up of the non-existent power trust and the constant inference that all the activities were being directed by responsible executives of the industry, acting jointly under centralized direction, have created an adverse public opinion, in the opinion of many, which will require time to correct. An example which is characteristic of literally hundreds of public statements concerning utility activities is had in the articles dealing with the alleged presence at the Democratic convention of Stephen Davis and J. S. S. Richardson. Fanciful stories were written as to their activities, when neither of these officials of the joint committee was nearer the convention than New York or Washington.

Probable Influence on Regulatory Legislation

In summing up the net effect of the first stage of the investigation observers friendly to the industry believe the standing of the utilities in the public's estimation has been injured. It is admitted that it has made more likely federal legislation dealing with the utilities and it is expected to result in a more stringent attitude on the part of the state commissions.

On behalf of the publicity men, it should be said the record shows that they felt obliged to do much bragging and work up many vainglorious reports in order to hold their jobs and to insure the continuance of the meager appropriations which they received for their work. The great majority of the articles submitted to newspapers have indicated, in the text, the source of material. There were instances where that was not done, but no case was found where the newspaper did not have full knowledge of the source of the material. It was pointed out in the testimony that many articles do not lend themselves to the mention of the source. To have lugged in the information bureau in connection with an article dealing with statements of facts, questioned by no one, would have passed no copy desk.

The witnesses first heard in the investigation were the official members of the staff of the National Electric Light Association. Their appearance at that time was largely for the purpose of identifying documents. They were followed on the stand by the witness who established as unfounded the charges by Willis J. Spaulding, the Commissioner of Public Property for Springfield, Ill., that the utilities were financing the Copley Press. Then began examination into utility activities in the various states. The investigation since that time has been a continuation of those examinations. Witnesses have been heard from all of the states with the exception of Oregon, Washington, Arizona, Idaho, Montana, Nevada, Utah and California. When the hearings are resumed, Sept. 1, it is planned to continue the investigation of the public relations work to develop just what part was taken by the individual power companies in carrying forward this type of activity.

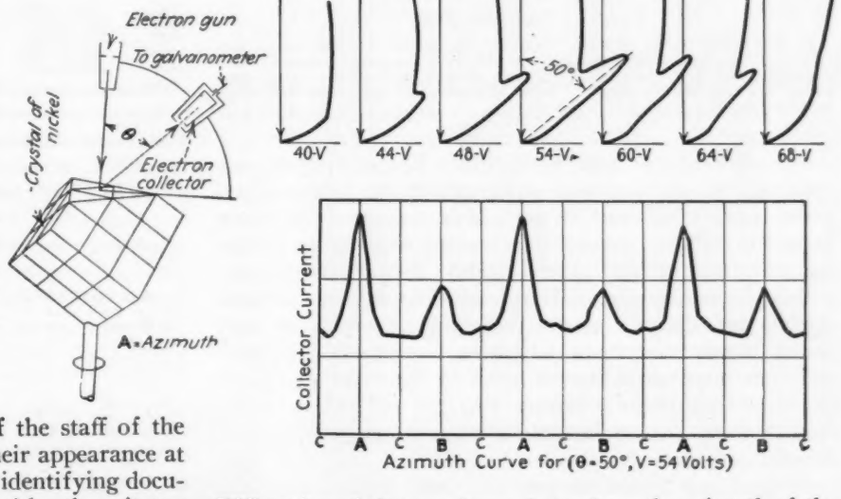
Officials of the commission are outspoken in their assertions that no straw has been placed in their way thus far in their examinations of the files and books of the National Electric Light Association, of the Joint Committee of National Utility Associations, of the state associations and bureaus. Every effort has been made by the industry, it is said, to facilitate the investigation.

Beam of Electrons Diffracted by Nickel Crystal

EXPERIMENTS conducted at the Bell Telephone Laboratories in New York City by Drs. C. J. Davisson and L. H. Germer show that electrons are reflected from a crystal of nickel in certain definite directions, much like X-rays. The scattering of X-rays in certain directions has always been explained on the hypothesis that these rays are an electromagnetic wave disturbance of the same sort as radio waves and visible light. The experiments with a beam of electrons show the same effects. The inference drawn by Dr. Davisson is that there is some sort of a wave motion associated with the motion of a beam of electrons.

The observed wave length of the electron beam was exactly that which is predicted by the quantum theory as developed by L. De Broglie, E. Schroedinger and others. This wave length is numerically equal to Planck's constant of action divided by the momentum of the electron.

In conducting the experiment with electron beams the source of the electrons was a hot filament, just as in ordinary radio thermionic tubes. These were accelerated by a positive grid voltage which could be varied at will. The voltages used ranged from about 50 to 375. The beam of electrons impinged on a nickel crystal, and some of them were adsorbed in it, others were scattered back from the surface of the crystal. Of those that are scattered back some come back without having lost any speed. A little collecting device was arranged so that it would be moved to various positions in front of the crystal to find how many electrons were scattered in the various directions without loss of speed.

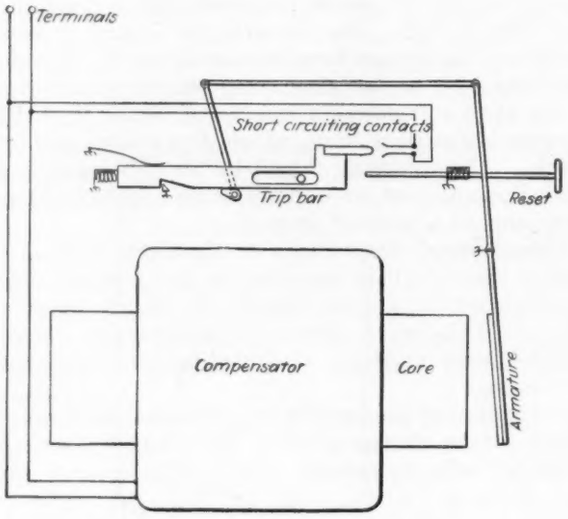


Diffraction of electron beam depends on the azimuth of the collector relative to the axes of the crystal structure

Compensator Cutout Prevents Communication Disturbances

By O. W. Holden
Junior Electrical Engineer Bureau of Power and Light, Los Angeles, Calif.

ELECTRIC utilities of southern California, as probably elsewhere, frequently are called upon by the telephone and telegraph companies to assist in clearing noise on their communication circuits which occurs coincident with the energizing of series street lighting circuits. Usually the trouble is due to a burned-out lamp in the compensator type of fixture. The compensator is designed to saturate with open-circuit secondaries, and under such conditions it may be conceived to produce harmonic voltages across its terminals, setting up charging currents in the series circuit having frequencies within the voice range. Telephone lines exposed to such circuits readily pick up, by induction, currents of sufficient intensity to make telephone conversation difficult or often impossible due to noise in the receiver. Certain types of radio receivers also are subject to interference from adjacent street-lighting circuits when lamps are out.



Short-circuiting device for series street lighting compensators

If the lamp burns out the flux set up in the compensator core attracts the armature closing the short-circuiting contacts and shunting out the compensator, thus obviating harmonic voltages being set up which might cause disturbance in communication circuits.

In studying means to prevent such disturbances, the Bureau of Power and Light of the city of Los Angeles has developed a cutout device to be installed in the lamp fixture which, as far as known, is the most satisfactory and economical solution of the problem. The device, as shown diagrammatically, consists essentially of an armature within the magnetic field of the compensator core, a trip bar which acts to close a short circuit across the fixture terminal leads and a reset pin which extends to the outside of the case.

When the lamp burns out, thereby opening the compensator secondary, the iron becomes magnetic, attracting the armature, which by lever and cam action releases the trip bar and closes a short-circuiting switch across the leads on the primary side of the compensator. As the lamp maintainer replaces the lamp he resets the cutout by simply pressing the reset pin.

This cutout was developed by L. G. Gould, street lighting foreman of the Bureau of Power and Light.

Hydro-Steam Production Costs Affected by Interconnection

THE effect of rainfall and volume of output upon generating costs in a system operating both steam and hydro plants is indicated in the accompanying tables. These data refer to the results obtained by the Southeastern Power & Light Company and were presented by W. E. Mitchell before the American Institute of Electrical Engineers in discussing experiences with interconnections.

TABLE I—PERFORMANCE OF HYDRO-ELECTRIC PLANT OPERATING IN A SYSTEM WITH STEAM PLANT

Year	Output	Load Factor	Maximum Demand	Unit Cost in Mills per Kilowatt-Hour Operation	Maintenance	Total
1923	153,094,600	29.4	69,500	....	....	0.155
1924	255,520,500	48.5	60,000	0.122	0.023	0.145
1925	227,387,000	44.0	58,500	0.117	0.073	0.190
1926	302,292,000	58.3	59,200	0.080	0.047	0.127
1927	291,880,000	56.7	58,000	0.074	0.131*	0.205

*Maintenance unusually high in 1927 due to cost of welding runners.

TABLE II—EFFECT OF RIVER FLOW ON SOME MONTHLY PRODUCTION COSTS OF A LARGE HYDRO-ELECTRIC PLANT OPERATING IN SYSTEM WITH STEAM RESERVE PLANTS

	High Flow	Medium Flow	Low Flow
Gross generation in kw.-hr.	38,474,600	16,505,800	9,250,200
Station use kw.-hr.	119,600	103,500	115,900
Net generation kw.-hr.	38,355,000	16,402,300	9,134,300
Peak kw.	58,200	50,000	36,000
Turbine hours	2,221	1,600	1,297
Operating cost	$2,270	$1,840	$1,745
Labor	$1,654	$1,524	$1,534
Material	$617	$316	$211
Maintenance cost	$2,266	$5,574	$8,919
Labor	$1,710	$1,670	$1,709
Material	$556	$3,904	$7,210
Production cost	$4,536	$7,414	$10,664
Substation cost	$921	$1,219	$946
Total payroll	$4,570	$4,653	$4,714
Average number men	43	46	46

Note: Maintenance during medium and low months includes contract expense shown under material for welding runners.

TABLE III—COMPARISON OF YEARLY STEAM-PLANT PERFORMANCE IN SYSTEM

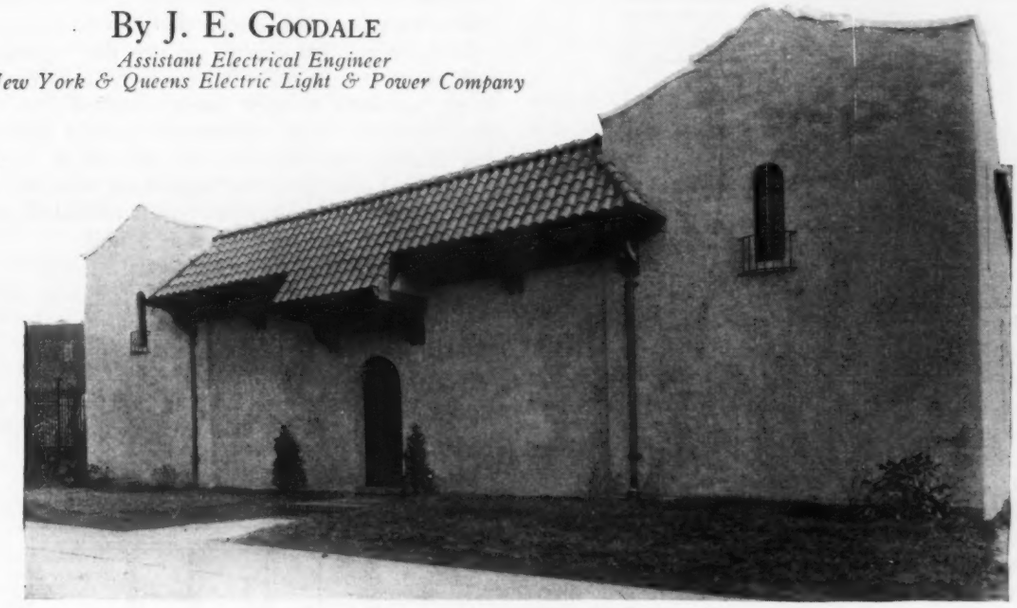
Year	Tons Coal per Year	Output, Kw.-Hr.	Load Factor in per Cent	Maximum Demand, Kw.	Lb. Coal per Kw.-Hr.	Unit Cost Mills per Kilowatt-Hour Operation	Maintenance	Fuel	Total
1920	118,159	88,088,100	20	45,000	2.56	....	....	....	6.30
1921	137,763	112,000,600	25.6	55,000	2.46	0.81	0.57	4.92	6.30
1922	188,773	188,414,600	43	55,500	2.00	0.40	0.40	4.00	4.80
1923	145,184	145,250,200	33.1	54,600	2.00	0.52	0.95	4.00	5.47
1924	198,947	207,678,000	34	78,500	1.91	0.38	0.49	3.82	4.59
1925	334,196	350,795,400	54	78,800	1.90	0.32	0.40	3.80	4.52
1926	190,624	198,064,800	29	78,500	1.90	0.50	0.73	3.80	5.03
1927*	263,807	276,553,800	46	75,000	1.90	0.34	0.52	3.80	4.66

*Eleven months only.
The cost of coal in the above figures is $4 per ton at the plant.

Attractiveness and Reliability

These qualities have been combined in remotely controlled and supervised Long Island substation at reasonable unit cost. Multiple feeds, truck type, phase-grouped breakers and cross-connected compensation

By J. E. GOODALE
Assistant Electrical Engineer
New York & Queens Electric Light & Power Company

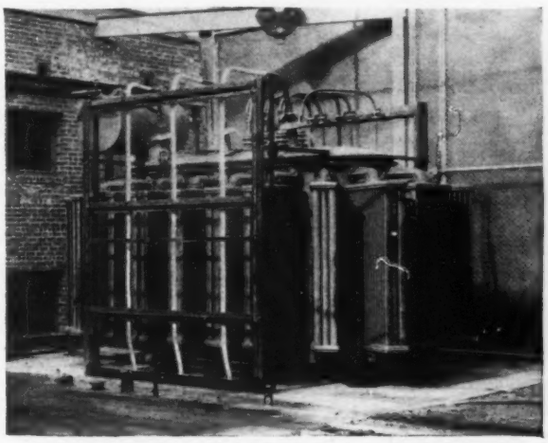


Provincial Spanish type of dwelling used for substation exterior

CONTINUITY of service and harmony with surrounding property were the governing requirements in the design of the new Woodside substation of the New York & Queens Electric Light & Power Company, which serves Queens, the largest of the five boroughs making up Greater New York. The cost per kilovolt-ampere is at least as low as that of many substations which are less attractive in appearance and not so reliable from the standpoint of service.

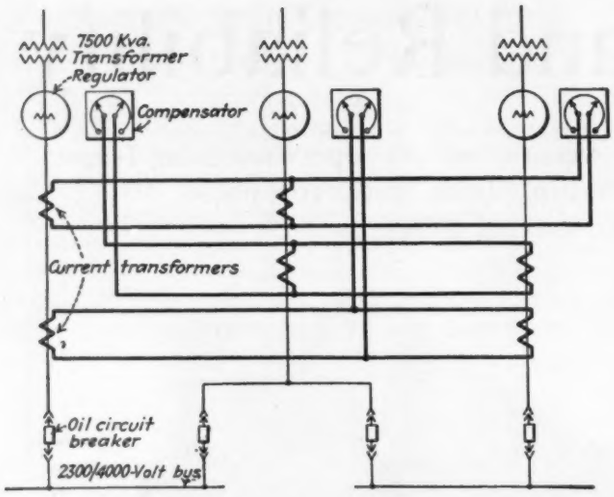
Consideration was given to building an automatic or a remote-controlled substation. Quality of service dictated the choice made. As demanded in a metropolitan section, it has always been the company's policy to furnish service as nearly free from interruption as possible. But the increasing use of electrically operated oil-burning equipments, electric clocks, radio, etc., is beginning to make 100 per cent service continuity imperative. An automatic substation without supervision and control from an attended station would not give the quality of service demanded. To supply such service it was decided that all of the operations in the substation should be under the direct and immediate control of some attended station. Furthermore, that all operations should be indicated at the control station. With such supervision it was not considered necessary to install automatic features in the station.

Inasmuch as the site for the station was on a business street, and because adjacent property had been built up with residences some of which were very attractive, it was felt that special consideration should be given to the building design. It was deemed advisable to erect a building which would not only be satisfactory to surrounding property owners but which would add to the attractiveness of the community. Several styles of architectural treatment were considered, but the Spanish provincial dwelling type was selected as the one best solving the problem presented by the site and surroundings. The building is of brick and steel construction with exterior finish in buff color stucco. The front gable has a roof of red tile. The characteristic windows are hung with iron balconies and the entrance door is of solid oak with period hardware.



7,500-kva. self-cooled transformer covered by wire-mesh glass roof

The substation is supplied at 13,200 volts by two three-conductor, 500,000-circ.mil,



Cross-connection of regulator compensators to assure proper load division

lead-covered cables coming from independent sources of power. When the third cable is installed it is expected that it will come from still another source of supply, so that the possibility of an interruption to the service of the station will be reduced to a minimum.

Single-phase truck-type oil circuit breakers are used. The poles of the 13,200-volt feeder breakers are not tied together mechanically, but are operated by one control switch. This is accomplished by paralleling the closing and tripping coils. Separate indication is provided for each pole, so that in case any pole fails to function properly notice of this failure will at once be given. All of the control leads for the truck breakers are provided with secondary disconnecting devices mounted in the top of each compartment. The use of single-phase trucks made it practicable to reduce the spare-breaker equipment for the 13,200-volt and 4,000-volt services to one truck each.

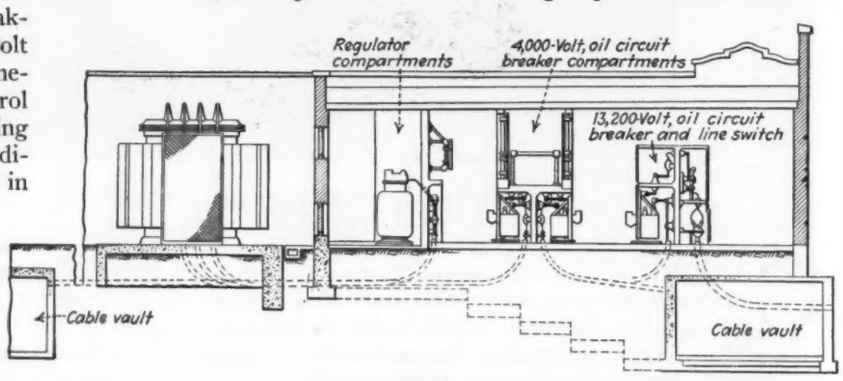
From the 13,200-volt switches single-conductor, Kerite-insulated cables are run to the oil-insulated, self-cooled, three-phase, 7,500-kva. transformers mounted on concrete platforms in the station yard.

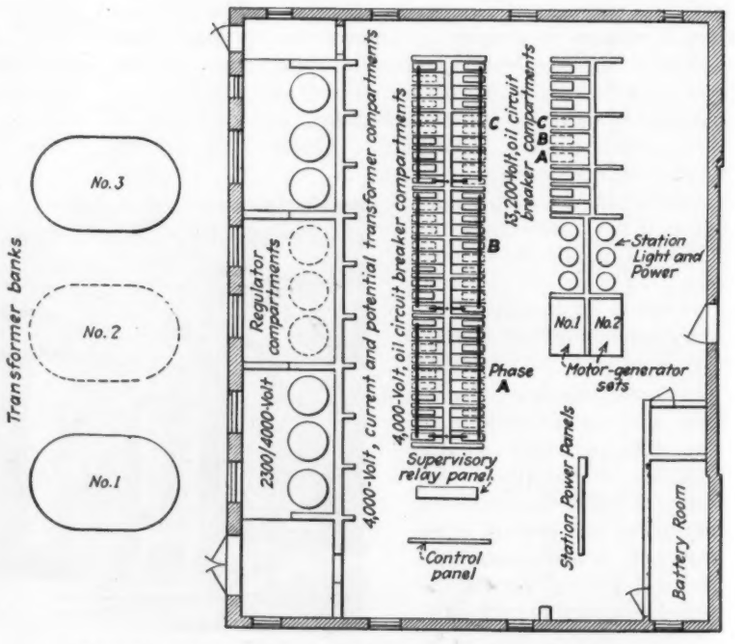
Inasmuch as the area served by the station is comparatively small, bus regulation is used. The regulators are installed in separate concrete structures so that trouble on any set cannot readily communicate itself to another. Ten per cent buck or boost in voltage can be provided when the transformers are supplying their maximum load.

Under normal operating conditions transformer bank No. 2 is out of service and the two buses are not tied together in the station. However, each feeder is looped between the buses, with an automatic switch installed either in a vault or on a pole approximately at the center of load. Therefore it is necessary to cross-connect the compensators on the regulators in order that the load will divide evenly between the two banks in service. Inasmuch as the third bank (No. 2) may be connected to both buses, thereby tying the buses together and operating the three sets of regulators in parallel, a double cross-connection scheme is used. A schematic diagram of the connections is shown. It will be noted that any regulator receives its compensation from two current transformers connected in the like phases of the other two regulated circuits. With any bank out of service, this connection acts as a straight cross-connection on account of the high impedance of the current transformer with the open primary winding. Experience with this connection at other stations where it has been used has shown the plan to work perfectly.

If only one bank is in service the regulators become non-automatic because the compensators receive no current, but with a spare bank installed this condition is very remote. The supervisory control system provides for reading the voltage and current in each regulated circuit and operating the regulators from the supervisory station. Differential protection is provided for the transformer bank and regulators as a unit.

The 4,000-volt bus is inclosed in a masonry structure and the two sections separated by an 8-in. masonry wall, Where necessary for strength, masonry barriers are installed between feeder oil circuit breakers. Elsewhere, ¼-in. boiler-plate barriers are used. It will be noted by referring to the station plan and section that the switches on each phase of the bus are grouped in the structure.





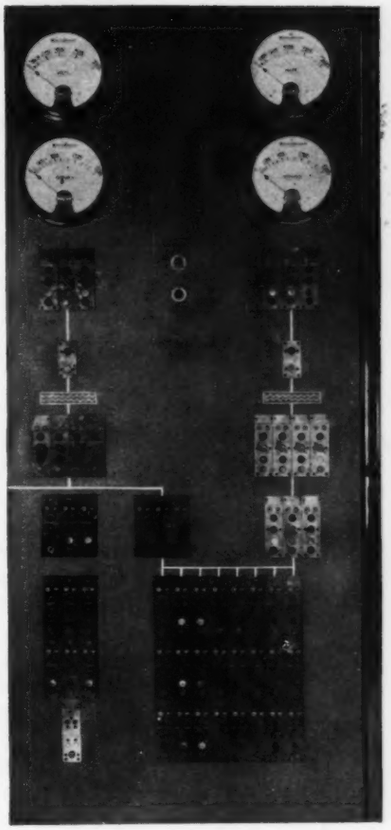
Grouping of 4,000-volt switches by phases is feature of substation layout

This grouping of switches on one phase makes it unnecessary to install three buses and avoids the usual connections from the bus to the switches which must, in the case of two of the phases, cross other buses if they are arranged in vertical formation. Relays and instruments used in connection with the feeder breakers are mounted on panels above the 4,000-volt bus structure. These panels face each other and are at such a height that all instruments and relays may be conveniently inspected, adjusted and tested. The wiring on the backs of the panels is inclosed by fireproof doors. Each section of the bus is protected by differential relays. It is interesting to note that in a similar station when the bus was accidentally short circuited the trouble was cleared with no damage to equipment and no interruptions to service.

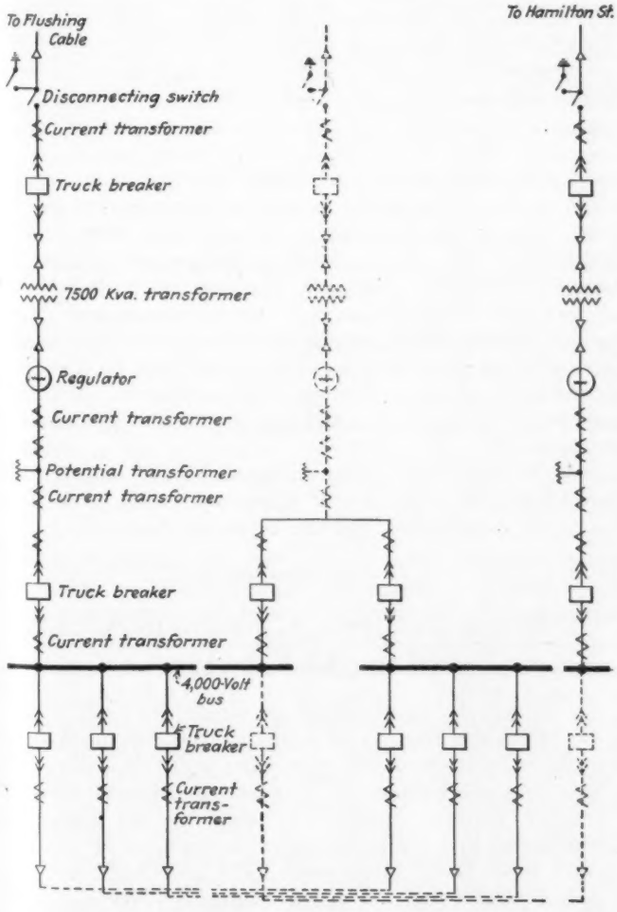
The phases of each feeder are run in separate ducts to cable vaults at either the front or rear of the station, where the three phases are brought together in one duct and run to the street duct system. The cables are so arranged that the two sides of the loop of any feeder do not come together in the same duct system, cable vault or pole line in any case.

Two banks of transformers supply the power and light requirements of the station. These banks are supplied from different feeders, which are in turn supplied by different 4,000-volt bus sections. The banks are separated by a concrete wall. Emergency lighting is provided by a throwover switch connecting with the station battery.

Two batteries are installed in one corner of the station. One battery, consisting of 60 nine-plate Exide cells, cares for the switching requirements, indicating lamps and emergency lighting. The second battery, rated at 48 volts, is for operation of the supervisory equipment. For changing the larger battery two 5-kw. synchronous motor-generator sets are provided. One of these sets floats on the battery at all times and is adjusted to carry the normal direct-current load. Should anything happen to this set the second set will automatically start up and connect with the battery providing voltage conditions are correct. Service from either set may be obtained by means of the supervisory control. The small battery is charged by a rectifier, which is left connected to the battery at all times. Resistance is provided in the circuit so that the battery may be floated and the normal 48-volt load carried by the rectifier. The direct-current control is entirely unfused. Cable with 155 mils of Kerite insulation is used for the main direct-current runs. Every effort has been made to make the control installation as free from trouble as is possible.



Supervisory control and indication board at attended substation



Schematic diagram of station switching

A panel is provided in the Woodside station so that all the equipment may be controlled locally if necessary. Normally no operator is present, but if it is desired to take the supervisory control equipment out of service for inspection, test or repair, or if it fails to function properly, an operator is immediately sent to the station. This is also necessary if equipment has to be blocked, tagged or grounded for construction work.

Inasmuch as no operator is normally at the station no heat is provided during the winter months except to prevent freezing of the plumbing in the toilet. Electric heaters are provided to warm the station if necessary. The heat from the regulators may be confined to the station if desired.

Synchronous Relay Supervisory Control

The supervisory control system used for the control of the station is the all-relay synchronous visual type and operates on a potential of 48 volts with a source of supply at both the Woodside substation and at the dispatcher's office, approximately 3.6 miles away. The equipment consists of two steel panels, on which are mounted the relays, which form the only moving parts of the entire equipment. In addition to these panels there is a dispatcher's steel control panel. On this panel are mounted the various control keys and indicating lamps by means of which the dispatcher controls the equipment

at Woodside. The control panel and one relay panel are located at the dispatcher's office and the other relay panel at Woodside.

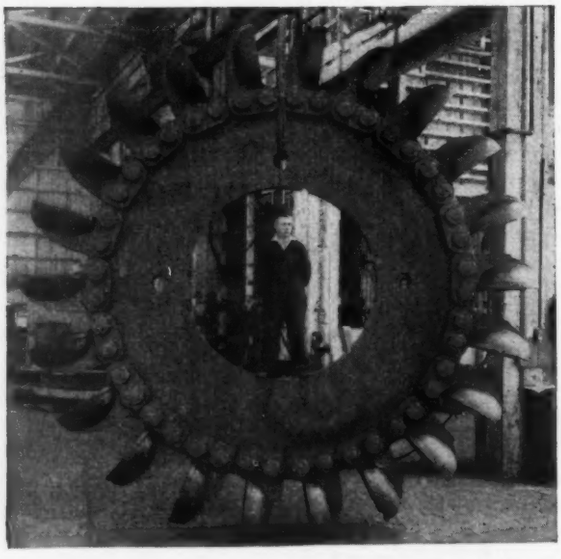
A ten-pair lead-covered control cable is installed between the two stations. Seven wires are used for all purposes associated with the supervisory equipment. Two of these wires serve to keep the relays at the dispatcher's office in synchronism with the relays at the Woodside substation. Four wires are utilized by these relays to select any desired control point. The seventh wire is used to operate a fire alarm and as a common return for the selective remote metering circuits. The remaining wires in the cable are considered as spares or are used for telephone communication between the dispatcher's office and substation.

EQUIPMENT FOR WHICH SUPERVISORY CONTROL IS PROVIDED

7	Three-pole oil circuit breakers with single-pole indication.
48	Single-pole oil circuit breakers (two per point).
10	Future single-pole oil circuit breakers (two per point).
9	Induction regulator controls, with voltage indication.
3	Induction regulator lockout controls.
3	Simultaneous three-line current indications.
3	Transformer bank temperature alarms.
1	Station battery and motor-generator set control.
1	Supervisory motor-generator set control, door alarm and station service transfer signals.
1	Automatic dummy circuit breaker test control.

Experience previously obtained with the type of control used has shown it to be very satisfactory from every standpoint. On similar sets of control equipment in operation for about one year only 176 failures to operate correctly occurred in 135,650 operations, or 0.13 per cent error. The failures were all of such a nature that no false operation or indications occurred, but rather that either an indication would not be transmitted or an operation could not be performed.

Pelton Wheel for 2,200-Ft. Head at Big Creek No. 2A



Two such wheels on a double-overhung unit will develop 56,000 hp. in the Southern California Edison Company's station. The runner is 16.5 ft. in diameter and weighs 25 tons. A feature of the wheel is the demountable type runner. Ring and buckets can be replaced in 24 hours.

Sterlington Carries Base Load for Three States

THE Sterlington station of the Louisiana Power & Light Company, which is on the Ouachita River about 20 miles north of Monroe, La., is the base-load plant and principal generating point of a large interconnected system that includes the lines of the Arkansas Power & Light and Mississippi Power & Light Companies as well as the Louisiana Power & Light Company. The transmission lines include 950 miles at 110 kv., 350 at 66 kv., 280 at 33 kv. and over 2,000 at 13.2 kv. This system covers a large part of the combined area of the three states. The average load density is low, considering the system as a whole, but the prospects for industrial and diversified agricultural development are bright. The station operates at unusually high power factor and during light-load periods, such as week-ends and holidays, at leading power factors which are as low as 25 per cent.

The plant contains two Westinghouse turbo-generators each rated at 12,500 kw. at 80 per cent power factor. Practically the entire output of the plant is at transmission voltages, there being three lines at 110 kv., three at 66 kv. and one at 13 kv. Louisiana natural gas is used, being piped from wells within a few miles of the plant site. The gas is fired in Duquesne burners in four 13,000-sq.ft. boilers, of which three, with outputs up to 13,000 lb. per hour each, are in normal use. The boilers operate under natural draft only and have no air preheaters or economizers. The turbines are bled at two stages for feed-water heating. All auxiliaries are operated from the main bus and are arranged for stand-by steam drive.

The plant is now being enlarged by the addition of two 30,000-kw. units, one of which will probably go into operation about May and the other in the summer.

OPERATING DATA ON STERLINGTON STATION (1927)

Power factor runs 98-99 throughout year; bus voltage is 13.2 to 13.5 kv.; steam pressure is 275 to 280 lb. (gage); superheat ranges from 111.7 to 119 deg. F.; number of employees 25 to 26.

	Per Month			
	Minimum	Maximum	Average	Yearly
Energy generated, 1,000 kw.-hr.	10,378	20,522	16,150	194,182
Per cent energy for plant use	1.80	2.73	2.3	2.3
Net energy for transmission	10,190	20,054	15,800	189,689
Maximum hourly generation	21,000	33,000	30,750	33,000
Maximum one-minute peak	22,200	35,000	32,440	35,000
Load factor (based on maximum hourly generation)	50.5	89.6	71.1	67.2
Capacity factor	77.3	116.2	99.23	.....
Serviceability factor	53.6	100	94.11	.....

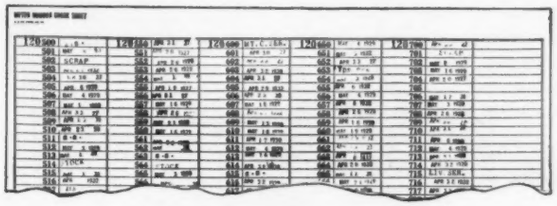
Northwest Domestic Customers Average 764 to 840 Kw.-Hr.

In the article on "Leaders in Home Service" which appeared in the May 26 issue of the ELECTRICAL WORLD the names of three of the companies in Table I, on page 1058, became transposed. The average figures for the Portland Electric Power Company for all domestic consumption and for consumption without water heating should have been, respectively, 774 and 532; for the Puget Sound Power & Light Company, 763 and 522, and for the Pacific Power & Light Company, 840 and 486.

Checking Meter Records and Customers' Ledgers

By W. G. Knickerbocker
Detroit Edison Company, Detroit, Mich.

THE large number of meters and accounts carried by a sizable utility makes the problem of record keeping and billing one of considerable magnitude. The standard of perfection is, of course, to know positively that every meter owned and used for measuring energy delivered to consumers is being billed properly. It is not the purpose of this article to discuss the daily routine for handling customers' orders, but to explain how a check of customers' ledgers and meter records was made without interfering with meter reading, billing or order



Meter audit record sheet

The date stamp does not show the date, but is a codified record of the individual meter audit. The month is the month of the audit reading, the day indicates the reading route number and the year is the identification of the audit clerk who made the record. "S.S." means sealed service and "MtC.Ser.," "Yps.Ser.," etc., indicate that the meter is in a particular suburban district and not, like the rest, in the Detroit service area.

routine. In developing the mechanical features of this check the work was simplified by the fact that the meters are numbered serially from 1. Therefore, sheets were prepared as shown in the accompanying illustration. These were arranged in eight books with 100,000 numbers in each book except book No. 8, which contained up to the last number issued (approximately 750,000).

Having prepared the sheets, the next step was to indicate in the space provided the status of all meters not in service. The meters not in service were classified as being in stock, sealed on consumers' premises, scrapped, used in metering for record purposes, missing, etc. By "missing" is meant those meters which were not in any stockroom and according to available records were not in service.

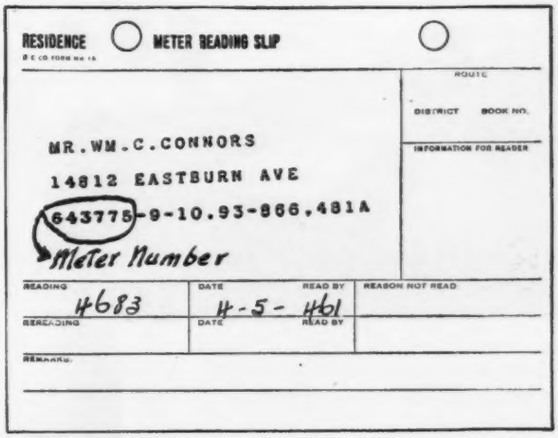
The field work in connection with this audit was done by the meter readers. The readers were instructed to visit every possible meter location, whether or not they had a reading slip. Meter readings are recorded by the reader on the 4 x 5-in. slip, shown here, which has imprinted thereon the customer's name, address, meter number, ledger number and file number. The above information is printed from an addressograph plate, which is also used to make the customer's ledger sheet when the account is opened. Therefore, the reading slips act as a continuous check of the ledgers. The territory is so arranged that each day's work constitutes a reading route and the day after the meters are read the readings are posted to the customers' ledgers, after which, under normal circumstances, the slips are filed. However, while the audit was in progress the reading slips for each day were sorted by meter number to the nearest five hundred. After sorting, they were divided into eight parts, corresponding to the eight books of numbers previously mentioned.

TABLE OF METER RECORD ERRORS

Nature of Error	No.	Per Cent of Total Errors
Incorrect addresses on meter cards	460	12.8
Meter dept. Cards show stock—Meters found in service and being billed	65	1.8
Meter dept. Cards show service—Meters in stock	37	1.2
Incorrect meter numbers on customers' records	1,997	55.4
Ledger record open—Account should be closed	625	17.4
Ledger record marked closed—Account active	403	11.2
Miscellaneous	21	0.6
Total errors	3,608	100.0

The fact that a reading had been turned in for a certain meter was then noted in the space after the corresponding number on the prepared sheets. This procedure was continued until all the territory had been covered and all meters on the lines read. Theoretically, every number in the eight books should have been accounted for. However, some were not; in other cases the information furnished by the meter reader was at variance with that shown on the records. All such items were carefully checked from all office records; also field inspections were made and, where necessary, the required corrections were put through the divisions concerned. It should be pointed out that even though errors were made during the progress of the audit, these errors were self-corrective and there was no effect on the final result, as in the end all meter numbers assigned had been accounted for. As an example, clerks sometimes noted after the wrong number that it had been read. Later another slip was turned in for the number noted. This left a number blank, which was looked up at the end of the audit. As a result of this audit a total of 3,608 errors, shown in the accompanying tabulation, were discovered and corrected.

It should be understood that the errors listed above did not or had not interfered with the billing of any customers. However, as a result of the check five

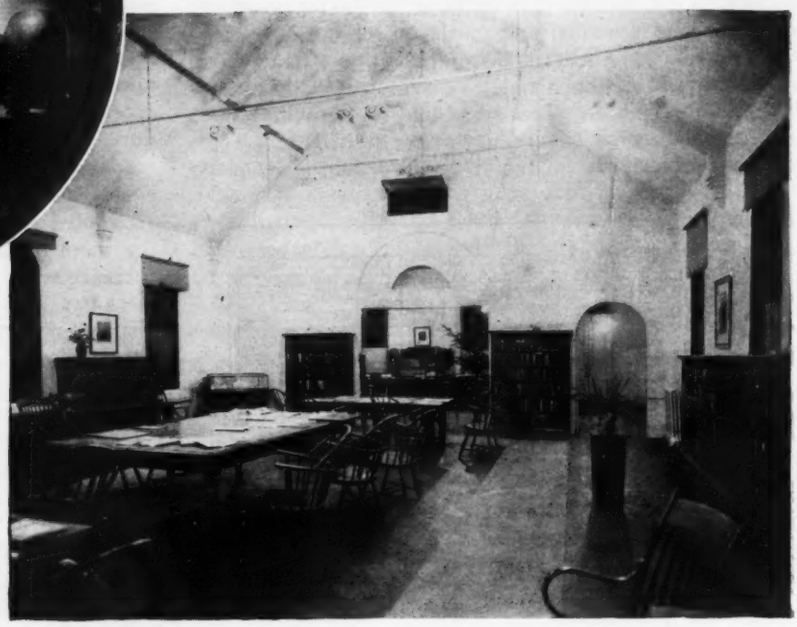


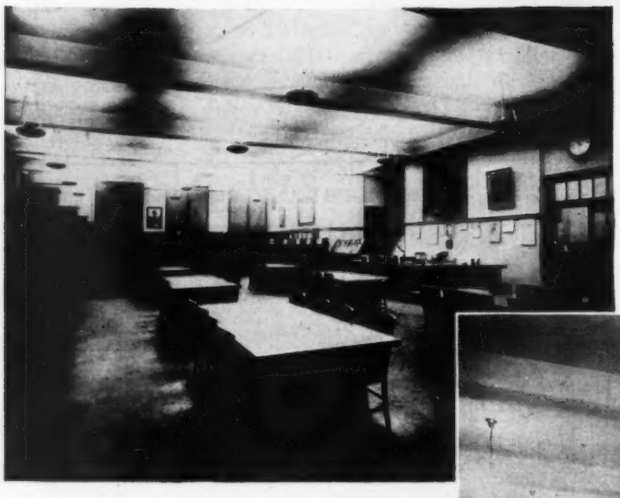
Standard meter reading slip used in the audit

meters were located in service for which no readings were being made or bills rendered. This represents one account per hundred thousand. The audit was not undertaken with the idea of finding a lot of unbilled accounts, but as a check between meter department records and consumers' ledgers. Without having in mind any criticism of customer order routine, it is the writer's opinion that such a check could profitably be made at intervals, say once each five years, in the average large utility.

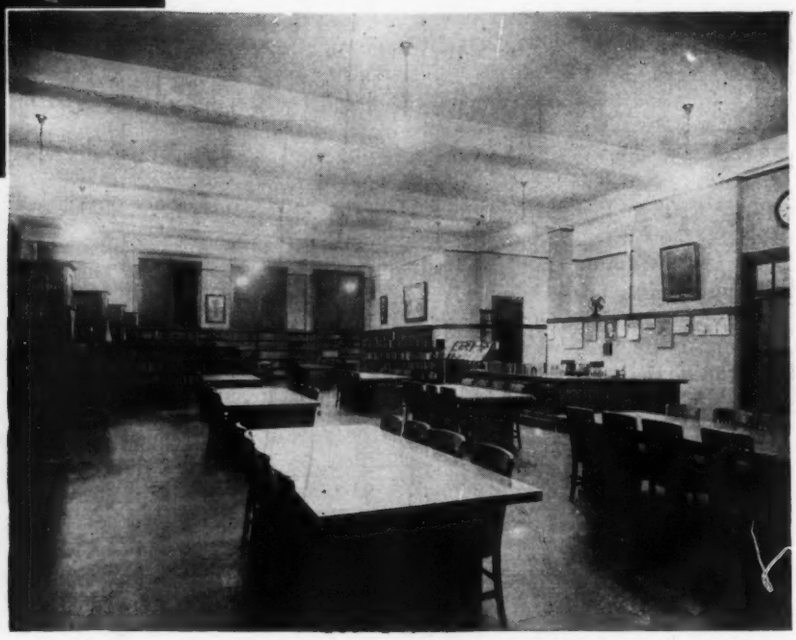
New England Libraries Improve Reading Room Illumination

Six 200-watt inclosing units eliminate glare and deliver 7.5 foot-candles at table level in the Newton Center library. Gas lamps with heavy glare and deep shadow effects were formerly used.





SEVERAL branch libraries on the system of the Edison Electric Illuminating Company of Boston have recently installed modern equipment supplying intensities of 7.5 to 8 foot-candles for effective and satisfactory illumination on the reading plane.



The East Boston branch library substituted 200-watt fixtures for the indirect units utilizing three 50-watt lamps and increased illuminating values from 2.25 foot-candles to 7.5 foot-candles and eliminated deep shadows.

Serving a Large Customer

Steps taken by an electric utility to provide efficient and continuous power supply. Method of meeting rapid increases in demand caused by additions to customers' plant

POWER service to industrial users today requires not only that the central-station company supply a continuous, uninterrupted flow of energy to its customers' plant but that the utility shall be in a position to furnish, on comparatively short notice, additional power to meet increasing demands resulting from the growth of industry in the company's territory. Typical of the Consumers Power Company's practice to keep step with and somewhat in advance of the requirements of its customers has been the development of service facilities to take care of the expansions of the General Motors Corporation plants located at Pontiac, Mich., where the power requirements have been increasing in blocks of 2,000 to 5,000 kw.

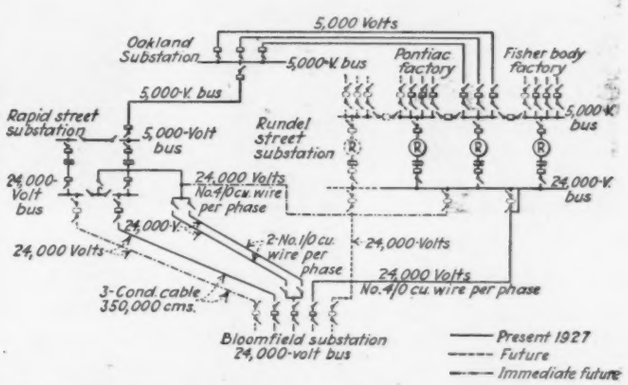
To take care of this load the Consumers Power Company selected a location from which three separate plants could be served and has designed and constructed a new substation from which no local distribution is taken. The new Rundel substation is the largest entirely unattended automatic substation on the company's extensive system. Its capacity is 22,500 kva., and it serves a purely industrial load, its output taking care of the entire electric requirements of three main factory units of the General Motors Corporation—namely, the Oakland Motor Company, the Pontiac plant and the Fisher Body Company, Pontiac division.

Three-Line Service to Insure Minimization of Interruptions

Power to the substation is now delivered over one 24,000-volt wood-pole transmission line, with an emergency supply from a separate source at 5,000 volts. The future plans call for the immediate construction of a second 24,000-volt wood-pole line over a widely separated right-of-way, with a third line still further in the future to be erected on the same poles as the present 24,000-volt line. The source of power for all 24,000-volt lines is the Bloomfield substation of the Detroit Edison Company, from which the Consumers Power Company purchases its entire supply for the Pontiac district. The 5,000-volt emergency line originates at the Rapid Street substation (an attended station of the Consumers Power Company) and is routed via Oakland Motor Company's substation to the Rundel substation. The foregoing arrangements are shown in detail in the accompanying diagram.

From the regulated 5,000-volt bus, three groups of feeders, each consisting of three circuits, radiate, one to the Fisher Body factory, another to the Oakland factory and a third to the Pontiac factory, so arranged that each group is fed by a transformer bank and a regulator. Additional feeders to the Fisher Body factory and the Pontiac factory are contemplated for the future. The oil circuit breakers on these circuits are of the automatic reclosing type.

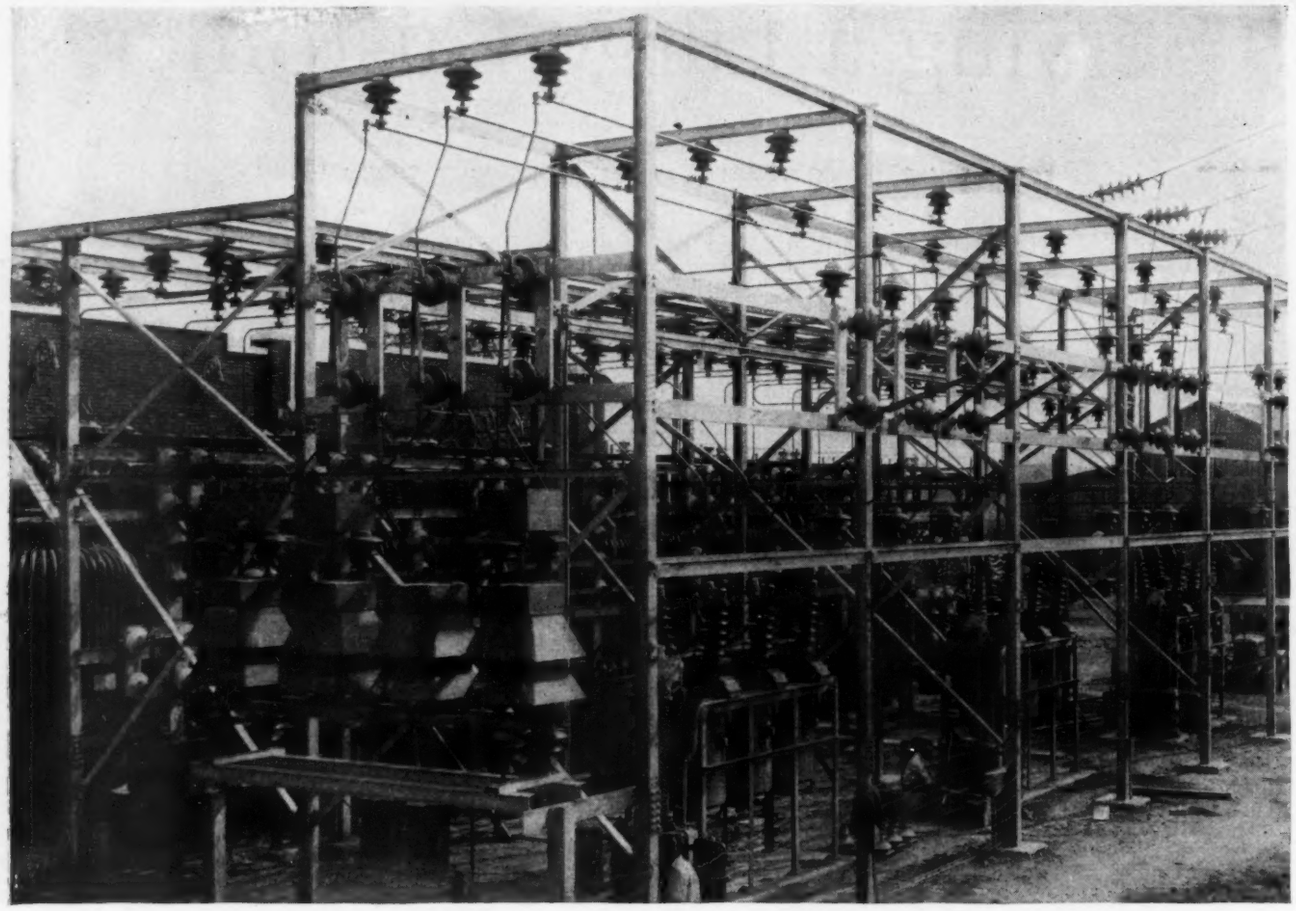
Automatic devices maintain the minimum transformer capacity in service which is consistent with the load on the station. The placing in and cutting out of additional transformer capacity is automatically governed by the operation of the transformer load relays. Under light load conditions the station will be fed by one transformer bank. When the load increases to approximately full load on this one transformer bank the load relays will operate to place a second transformer bank in service. Then the tie breaker in the 5,000-volt bus between these two transformer banks will open. Thus the 5,000-volt bus will be sectionalized, with a section being fed by each



Switching arrangements and tie lines between Consumers Power Company's Rapid and Rundel substations and the Pontiac, Fisher and Oakland plants

of the two transtormer banks. A further increase of load to approximately full load on the second transformer bank will cause the load relays on this bank to operate and place in service the third transformer bank. The tie breaker in the 5,000-volt bus between the second and third transformer banks will then be open. Each transformer bank will then be feeding its share of the 5,000-volt bus with the bus-tie oil circuit breakers open.

When the load decreases below the capacity of two transformer banks, the load relays on the last transformer bank placed in service will operate and in doing so will remove that transformer bank from service and close the tie breaker in the 5,000-volt bus between the second and third transformer banks. The second transformer bank placed in service will now be feeding an additional section of the 5,000-volt bus, due to the closing of the bus-tie breaker. A further decrease of load to the point where one transformer bank may safely carry the station load will cause the load relays on the second transformer bank to operate and remove this transformer bank from service, at the same time closing the bus-tie breaker in the 5,000-volt bus between the first and second transformer banks. Thus one transformer bank will then



30,000-kva. outdoor substation to serve three automotive plants. 22,500 kva. now installed

be carrying the station load with the bus-tie breakers closed.

The control is so arranged that the No. 1 transformer bank is the preference bank. The switching equipment is so interlocked that the switching occurs without interruption to service.

The two 24,000-volt incoming lines will be protected from overloads and grounds by power-directional overcurrent and power-directional ground relays.

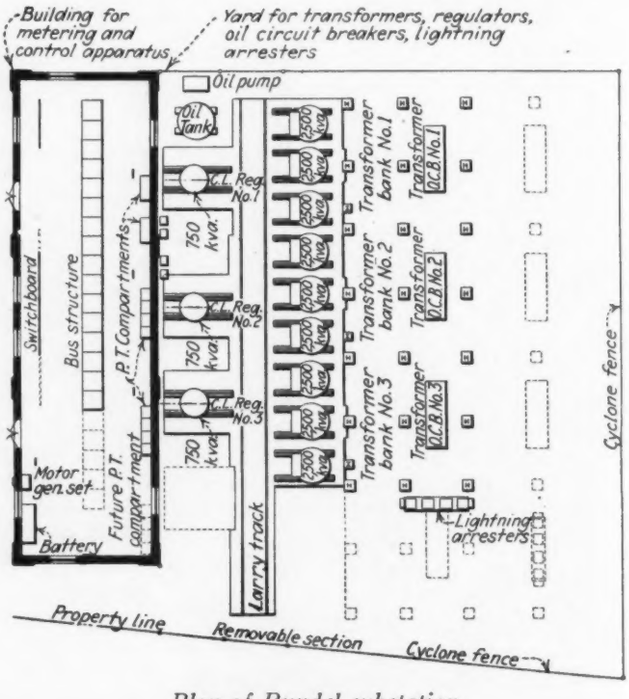
Differential Relays Protect Transformer Banks

Each transformer bank is provided with three differential relays and a ground relay on the 24,000-volt side. Three straight overcurrent relays are provided on the low-tension side of these transformers for protection in case of bus faults. Each of the 5,000-volt feeders is protected against faults by overcurrent relays.

Internal transformer trouble is taken care of by the differential relays which operate to open the high- and low-tension oil circuit breakers and to lock them out, thus disconnecting the transformer from the 24,000- and 5,000-volt buses. If the bus-tie breaker should be open at the time the high- and low-tension oil circuit breakers are tripped, it will automatically be closed, thus allowing the other transformer banks to carry the load of the transformer bank in trouble.

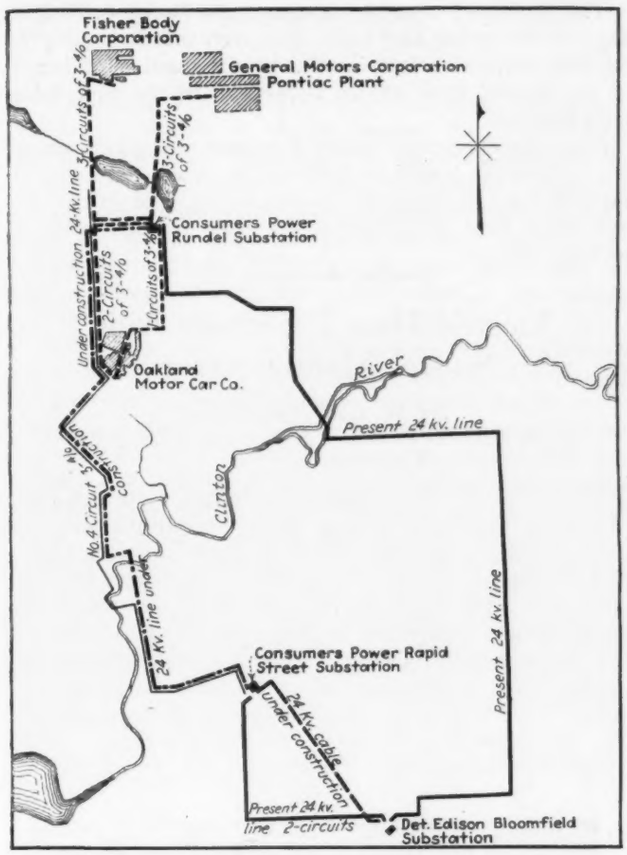
A ground on the 24,000-volt side of any transformer bank will cause the ground relay on this particular bank to operate and a repetition of the switching performed by the differential relays will occur.

If a short circuit occurs on any 5,000-volt feeder, the



Plan of Rundel substation

The substation is equipped with three banks of transformers, each bank consisting of three 2,500-kva., 24,000/5,000-volt transformers. A three-phase, 750-kva. induction voltage regulator is connected between each transformer bank and the 5,000-volt bus. Each transformer bank is connected to the 24,000-volt bus through a high-tension oil circuit breaker and to the 5,000-volt bus through a low-tension oil circuit breaker. Two bus-tie breakers are provided for sectionalizing the 5,000-volt bus into three sections.


Fisher Body Corporation
General Motors Corporation Pontiac Plant
3 circuits of 3-4/0
Consumers Power Rundel Substation
Under construction 24-kv. line 3 circuits of 3-4/0
2 circuits of 3-4/0
Oakland Motor Car Co.
River
Present 24 kv. line
Clinton
No. 4 Circuit 3-4/0 Under construction
24 kv. line under construction
Consumers Power Rapid Street Substation
Present 24 kv. line
24 kv. cable under construction
Present 24 kv. line 2-circuits
Det. Edison Bloomfield Substation

Layout of transmission and distribution circuits to assure continuous service

oil circuit breaker will be tripped by the overcurrent relays and will reclose at two-minute intervals if necessary and lock out when tripped three times in succession. If the condition arises when more than one feeder oil circuit breaker is tripped at the same time, they are reclosed one at a time.

Tests showed that there was a diversity factor of between 80 and 90 per cent of the measured demands among the three plants, so that by metering all three on the 5,000-volt bus at Rundel substation and leasing the lines serving the various plants the General Motors Corporation could effect a considerable saving in cost of energy used by taking advantage of the higher demand billing of the rate schedules as well as a 15 per cent lower demand due to the diversity factor of the three plants involved in the arrangement.

In case of failure of both 24-kv. lines an emergency 5,000-volt tie line between the Rapid Street and the Rundel Street substations via the Oakland substation can be put into use by simply closing an oil circuit breaker at the Oakland plant. This is capable of handling approximately 1,500 kw. The scheme of circuits is shown on the accompanying map.

Two of the three sets of 5,000-volt lines are overhead wood-pole construction, and the new line to the Pontiac plant is a Bates Steel tower line. In the construction of these lines every precaution was used to insure reliability of service, such as extra heavy corner construction, excessive lightning protection, like phases always in a vertical line on the arms in case of more than one circuit on a lead and splitting lines to same lines over different routes where possible.

Customers' Hall Facilitates Service

A FURTHER refinement in service to its customers was instituted by the Milwaukee Electric Railway & Light Company this spring when it completed the equipment and furnishings of its customers' hall. This hall, which is situated on the second floor of the Public Service Building, was designed primarily for the customers' convenience in their transactions with the company. It is so arranged as to obviate any inconvenience to a customer through being shunted from one office to another in search of the right department to answer his questions or take care of his requests. Except for the actual sale of appliances, which is conducted in the merchandise display room on the first floor, all facilities for the transaction of business are centralized in the customers' hall.

As will be seen in the accompanying illustration, the hall is an imposing and dignified room which at the same time has been designed to afford convenient and comfortable negotiations between customers and employees. Each department is clearly indicated by an illuminated sign and provision is made for taking care of customers' requirements under the following general classifications:

Information.—General information counter with competent attendant.

Cashiers.—Payment of bills pertaining to electric service, merchandise, trouble calls, repair charges, final bills and installment accounts.

Securities.—Purchase of securities. Installment payments and general information concerning securities.

Service Applications.—Applications for connections or disconnections of electric service.

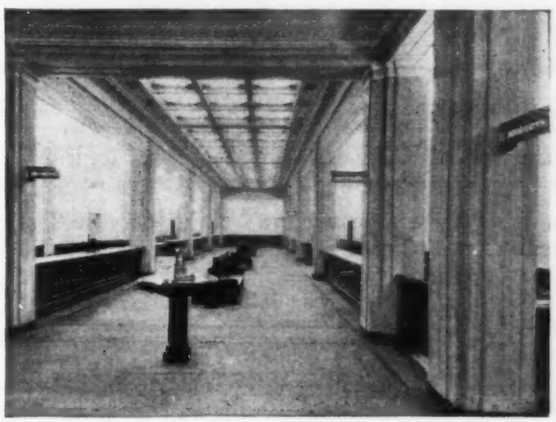
Service Information.—Pertaining to status of electric service orders and installations.

Duplicate Bills.—For electric and steam service and merchandise accounts. Final bills and meter card readings.

Adjustments.—Adjustments of complaints and inquiries on electric service bills and on merchandise and repair charges.

Treasury Department.—Offices of treasurer and secretary.

Supplementing the facilities afforded by the arrangement of the main hall a number of conference rooms have been provided at the rear of the counters, where



New customers' hall of the Milwaukee Electric Railway & Light Company

negotiations of an extended nature may be carried on with convenience and privacy. Also, back of and immediately adjacent to the customers' hall is located the customers' accounting department, which greatly facilitates the rendering of duplicate bills or looking up data on individual accounts. Since the hall has been opened

Rural Service

"The idea of electric service on the farm is established. . . . In farming we are going from a land-holding to a land-operating proposition. . . . Marginal land is a glut on the market. There is a premium on fields which can be machine worked. . . . responsibility of the power company to make reliable electric service available to the farm on a sound business basis."

DR. E. A. WHITE,
Director Committee on the Relation of Electricity to Agriculture.

it has been found to be not only a great convenience to customers to be able to go directly to the department desired but has also enabled employees to handle customers' requests more rapidly and with less chance of error or confusion.

Materials in Show Windows Fade Less in Artificial Light

BY M. LUCKIESH
Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland, Ohio

NUMEROUS tests conducted during the past few years have shown that the value of a show window or show case may be greatly increased by the use of high-intensity artificial illumination. However, the lighting salesman sometimes encounters the objection that the goods displayed may be damaged by fading.

While it is true that most dyed goods can be partially faded by light if exposed for a sufficient length of time, we have found that daylight is probably responsible for the major portion of the fading which occurs in the average show window. We have exposed colored materials under glass under various conditions of natural and artificial light and have found that the following exposures caused approximately equal amounts of fading:

500 foot-candle-hours exposure to gas-filled Mazda lamp
180 foot-candle-hours exposure to skylight alone
430 foot-candle-hours exposure to sunlight and skylight

In a survey of the windows of 26 Cleveland stores Harrison and Sturrock found an average daylight illumination of 235 foot-candles on the display. At the present time the display in a well-lighted window at night is illuminated to an intensity of approximately 50 foot-candles. Hence, if we assume that the daylight illumination does not include direct sunlight we find that one hour of exposure to daylight in the average window does as much damage as thirteen hours exposure to 50 foot-candles from "Mazda" lamps.

Expressed in another way, we found that the following exposures produced approximately the same amount of fading:

"Mazda" lamps	100 foot-candles for 500 hours
Skylight	450 foot-candles for 40 hours
Sunlight and skylight.....	3,900 foot-candles for 11 hours

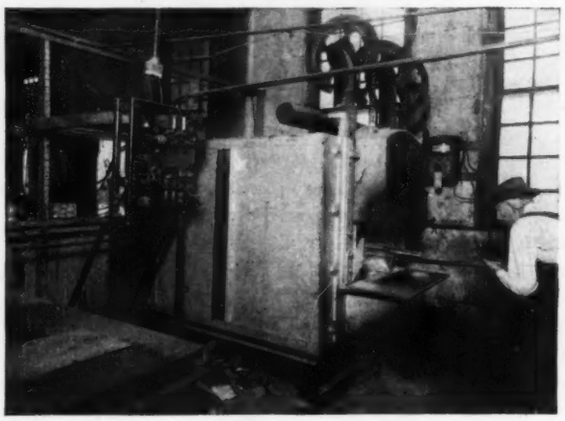
The daylight values are average conditions on bright days in the spring and fall. It is seen that by multiplying the number of foot-candles by the number of hours in the second table values related as in the first table are obtained.

From the foregoing results it is seen that goods which are sufficiently stable in color to be worn outdoors in daylight may be exposed to artificial light of intensities ordinarily used on displays for long periods without serious damage.

Electric Heat Treatment Aids Shovel Manufacturer

BY W. G. DAVIES, JR.
Power Engineer Tennessee Electric Power Company, Chattanooga, Tenn.

SEVENTY-FIVE kilowatts in electric oven and furnace units and 132 kva. in welding apparatus are now in use at the plant of the American Manufacturing Company in Chattanooga and the flexibility of electric heating has proved most convenient in a recent rearrangement of the productive equipment of this establishment. Due to this rearrangement, the management states, the cost of making some of the company's products has been cut from 15 to 30 per cent. Electricity is used in heat treating, japan baking, resistance and spot welding. The maximum fifteen-minute demand for the month of the motor and heating service in this plant is less than 50 per cent of the connected load.



Heat-treating one shovel per minute electrically

One shovel per minute is heat treated in this plant at 1,500 deg. F. in a 30-kw. electric furnace and the company is planning to expand this service to heat-treat all the shovels which it makes. Resistance welding is proving successful in attaching handles and shortly all shovel welding will be electrically done, replacing an oil furnace and drop hammer. The company uses the heat-treating furnace for die hardening, for its own service and for neighboring factories, when the equipment is available. In this plant a 45-kw. electric japanning oven recently replaced a gas-fired oven used in baking japan on small metal harness parts and similar hardware. The cost of electricity is about the same as that of gas and oil, but the fire hazard is considerably less with electric heating, the oven being located at a point remote from the gas and oil supply. In this plant 110 kva. in spot welders is kept busy all the time in the manufacture of small hardware.

Utility Prefers Aiding Dealers to Selling

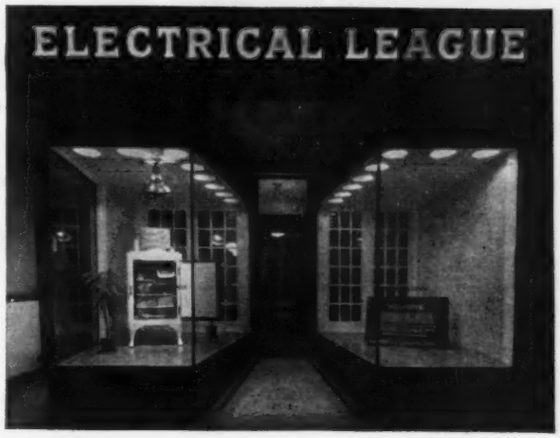
CONCENTRATING its energies upon the generation and sale of electric power, the Metropolitan Edison Company, Reading, Pa., a subsidiary of the General Gas & Electric Corporation, does not engage in the merchandising of electrical appliances. It does, however, co-operate with the electrical dealers and contractors throughout its large territory in promoting the sale of electrical equipment for residential, commercial and industrial use.

One of the results of this co-operation in Reading has been the organization of the Electrical League, composed of the principal electrical dealers and contractors in the city, wholesalers and jobbers of electrical appliances and representatives of electric appliance manufacturing concerns doing business in the territory. A permanent headquarters has recently been established on one of Reading's important business thoroughfares which is, in reality, a cross-section of a model electric home with complete electrical equipment installed in living room, dining room and kitchen. Half of the floor space is devoted to this home exhibit. The other half, used for the display of larger pieces of electrical equipment, represents a small mercantile establishment. Industrial equipment is shown in the basement.

The Metropolitan Edison Company co-operated to a large extent in establishing the new headquarters of the league. Plans for the display room were prepared by the company's own architect and the construction work was under his personal supervision. The elaborate system of wiring was laid out by the company's lighting engineer, and it assisted in procuring the special lighting equipment that has been installed.

The Electrical League headquarters was established for the purpose of demonstrating to the public the latest development in electric lighting in all of its phases and the use of household and other types of electrical appliances. It is open to the public and an invitation is extended to bring electrical problems to the league for solution. League members bring their customers to the rooms to show them the latest types of electric lighting actually in use. The equipment in each of the several demonstration rooms is changed every two weeks, giving each member of the league an opportunity to display his particular line of merchandise and giving visitors the assurance of seeing something new every time they come to the league headquarters.

None of the equipment displayed is for sale here, nor are orders solicited by the secretary, who has his office in a corner of the display room. In the front of the building are two show windows, one of which is used by the dealer members of the league and the other for general display purposes. In the basement, used for meetings of the league, there is a display featuring industrial lighting. To show the results obtained from various types of equipment and intensities of light, there are six circuits arranged for comparative demonstrations.



Headquarters of Electrical League sponsored by non-merchandising utility

No salesmen, no solicitation of orders and no equipment for sale is policy in this showroom and demonstration hall of Reading (Pa.) league.

The actual opening of the Electrical League of Reading headquarters several months ago was preceded by a number of years of co-operative efforts between the electrical dealers and contractors and the Metropolitan Edison Company. About three years ago the company showed its interest in the development of a field for the sale of electrical equipment by staging an elaborate electrical exposition. It was shortly after this exhibit, which

Some Benefits from Holding Companies Reported by Operators

Better service and lower rates for smaller communities.

Intimate exchanges of experience between men in like positions but remotely located.

More talented advisory service than average-sized companies can support independently.

Research and development work can be centralized.

New capital obtained at lower rates than average-sized company can command.

Undertakings that might be difficult to tackle alone can be financed.

New capital obtained as needed so minimum will remain idle.

Demands on construction and engineering organizations of operating company smoothed out by holding company taking peaks.

Better purchase prices on equipment bought in quantities like poles, wire, meters and transformers.

Leaves local company free to handle operating problems and contact with customers.

Concentrates major accounting and reports to commissions and government.

continued for a week and attracted thousands of people, that the league was formed. Little more than a year later the company was again active in the interests of the dealers and contractors when it supported a model electric home in one of Reading's fashionable residential districts. This was followed by a house-wiring campaign, in which all solicitation for the wiring of homes was done by solicitors employed by the Metropolitan Edison Company, who turned over hundreds of signed house-wiring contracts to the dealers.

In its advertising the company points out in a general way the advantages of using electrical equipment such as fans, sewing machines, heaters, good lighting, refrigerators, etc., referring prospects to dealers who supply the material.

Letters from Our Readers

Old Habits Cling in Industrial Field

To the Editor of the ELECTRICAL WORLD:

Several convictions which I have always harbored in my mind called most forcibly for printed expression after reading the excellent article on "Quality Industrial Lighting" by A. A. Brainerd in the Feb. 4 and March 31 issues of ELECTRICAL WORLD. The thoughts most pronounced to my mind are the following:

1. The enormous mass of wastage accumulated the last third of a century through the failure to utilize to better advantage either natural or artificial light, which was available as time progressed.

2. The indifference which hides from those in charge of industry the importance of quick, clear vision and how to utilize light to get it.

3. The fact that industrial management is largely satisfied and not interested enough to sell itself the idea, or let others do so, that of all the means it has to produce with, light is the most important and could be least dispensed with.

4. The mass of money that is willingly given for materials and labor for production and the mere pittance limited to and occasionally doled out in the yearly budget for improved artificial lighting equipment are inconsistent.

5. The need to encourage those of minor position, but to whom lighting is left in a plant, the importance of selling themselves and the management the idea that investments for improving lighting equipment are not extravagant raids on the expense account, but are cold-blooded business investments to protect yearly expenditures for labor, materials and equipment which are easily a thousand times greater.

6. The need to ease the ocular and mental tension of the worker, who by means of light reflected back from his work conceives a mental picture of that seen, the relation of which to his memory of similar objects previously seen becomes the means of guiding his productive actions, and thereby the individual becomes the only truly, automatic machine. His important value is easily recognized by the wages paid, because this would warrant an investment of over $15,000 if it were possible to replace him mechanically. The inefficiency and variation in the application of light in industry, to the pictures these human machines have to see in most industrial establishments, are so far below what they should be and the cost of improvement is relatively so small that any gain is important.

7. The thoughts of the amount of unused land around the factories for light areas, varying amounts and kinds of glass used to admit light into the buildings, the varying colors and the extent to which this glass is painted after being in use to keep out excess light present striking inconsistencies in the use of natural light. Again, the limited desirable locations for natural light and the inefficient use of floor space make costly the operations and should include the extra expense of transporting within the building the products in the process of manufacture.

8. The variation of natural light in the factory during the daylight hours from a fraction of a foot-candle to several hundred, which substantially changes each hour of the day and almost every day in the year, is a striking illustration of not recognizing the possibilities and economies in the application of modern science to determine and use the best and most uniform method of artificial lighting, which can be maintained alike day or night, winter or summer, stormy or clear.

9. The thoughts of the great army in industry who believe daylight to be the best and cheapest for near, intensive work within buildings are striking portrayals of the slowness with which old customs are replaced with new.

10. It gives striking thought to note that when a small object is taken by an executive for observation, he first turns it so that the best available light falls on it at just the right angle. Often he will take it nearer the window or to some available light. While he does this, he is unconscious of the poor condition of light which the operators have in the process of production. It is necessary to study the exact conditions under which the worker is required to observe, and by the practical application through continuous periods of operation, which are similar to that the worker is under, to obtain the effect on the worker, particularly in the last hour of the working period. The difference between the sixteen ocular registrations in the first two seconds is vastly different from those at the end of a four-hour period, which if it were possible to stand close, observing concentration for that continuous period, over one hundred thousand eye movements and pausations would have been exercised in nature's process of producing mental pictures on the worker's mind.

Inasmuch as the conception of things seen is mental, the rapidity with which the mind can conceive what is before the eyes must necessarily be subdivided in small detail pictures in the same manner as we read the page of a book, and is unlike the unconscious eye of the camera, which conveys to the sensitive plate the entire picture within its capacity.

The difference is because there is so much more in the picture than the mind can absorb at once that nature has provided a means to subdivide it into small pictures which are within the capacity of the mind to absorb. For instance, observe the visible hits of the shots from a machine gun being fired at the rate of eight shots per second and directed toward the various objects desired to hit. The mental picture obtained is not of each hit, but the memory of the general result of what was hit, and its meaning.

The principal idea, which is not generally recognized and should be realized, is the enormous activity both ocular and mental, in the wonderful automatic mechanism given us through sight. How much more efficient we can be if light can properly be applied to lessening of sight resistance, and the billions of dollars lost each year makes it so important that our efforts be in this direction.

It should be understood that the needs for proper light in the office are very much less exacting than those in the factory for the following reasons:

Office work consists principally of objects having height and breadth, like letters on the flat printed page, while in the factory the work consists largely of objects that have depth in addition to height and breadth. Objects in the factory require about four times the amount of shadow casting light to that of diffused light. While the former does not need varying degrees of brightness on the surface of the letters, the projecting and receding shapes of objects in the factory do need it.

Time is a vital element in industrial activity. Because of the fact that two individuals can see an object with supposed equal clearness, one may require several times longer in fractions of a second to do so, and much is to be done in determining these time studies in both lighting and viewing most objects which have third angle dimensions.

It should be better appreciated that multiple shadows or highlights produced at the same time by more than one light source are counteracting and will not give a clear, true picture.

One of the largest costs that industry pays for inefficiency is the necessity for workers to fight nature by attempting to open the pupils wide enough so they can see the darker details of an object in too much background light.

ARCHIBALD T. SAMPSON.
Sampson Axcess System, Inc.,
Lynn, Mass.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

New Gate Application at Paugan Falls.—A description of the design, construction and installation of the closure gates at the Paugan development of the Gatineau Power Company is offered in this discussion. The gates were designed for the purpose of shutting off the flow of the river through the bypath, a channel which allowed the water to pass down to other developments in order that they could continue operating while Paugan's power house and dam were being constructed. This bypath is a deep channel capable of taking care of the full flow of the river and was excavated from the pool above the falls to the west channel below the gorge. On the completion of the development this channel will take the discharge from the regulating gates. In the meantime the closure gates have been lowered into position, placing the water on the up-stream side of the normal working elevation and allowing it to flow through the gate opening at the other side of the island thus formed. A self-closing feature is included in the design of this apparatus. The opening in the dam will be closed with concrete, so as to make a permanent dam across the entire width of the stream. The gates will be left in position as the cost of removing them would outweigh their value.—*Electrical News* (*Canada*), June 1, 1928.

The Upper Saguenay.—The developments and plans for future and present utilization of the hydraulic possibilities of the Upper Saguenay River have been discussed in this article, with particular reference to the industrial plants whose activities are closely related to the power projects. The present installation, that of the Isle Maligne power house, at which twelve units of 45,000 hp. each have been installed, is covered both as to engineering features and economic utilization of the generated energy. The future development, that at Chute-à-Caron, which is now under way and will be completed in the near future, is also covered. — *Electrical News* (*Canada*), June 15, 1928.

Transmission, Substations and Distribution

The Vibration of Transmission Line Conductors. — THEODORE VARNEY. — Records are given of vibration in actual transmission lines under widely varying conditions and with various conductor materials. These observations indicate the limiting values of wave-length frequency and amplitude of such vibrations encountered in service. Laboratory experiments are described in which the observed conditions were artificially reproduced in a large conductor. The stresses adjacent to a point of support were studied with the aid of a microscope and the wave shape was plotted and the energy required to maintain vibration recorded. All conductor vibration breaks observed in practice have occurred at supported or badly made joints. The conclusion is reached that if the radius of curvature at the support can be maintained at least equal to that at the center of the loop no breakage will occur. Mathematical expressions are given for determining the radius of curvature at the center of the loop, the bending moments at a support and the necessary additional amount of conductor stiffness at the support to justify the desired conditions.—*Journal of the American Institute of Electrical Engineers*, May, 1928.

Automatic Substations.—The considerations involved in the construction and design of a number of automatic substations in one district in England have been presented in this discussion. The method of illuminating the substations is offered as an unusually satisfactory means of securing the desired results for such service. In these installations supervisory-control equipment is used, as is main switchgear of the compound-filled, metal-clad, horizontal draw-out design. The converter oil circuit breakers are operated by three-phase motors, the supply of which is taken from the potential transformers incorporated in the switchgear. — *Electrician* (*England*), May 25, 1928.

Units, Measurements and Instruments

Cathode Ray Oscillograph for Lightning Records. — K. BERGER. — The recording of lightning disturbances with the aid of the Dufour cathode ray oscillograph is not readily accomplished, since the exact time instant of the disturbance is unknown and uncontrollable. Hours may elapse before the occurrence of a phenomenon lasting a few thousandths of a second. During the waiting time a potential of up to 60,000 volts must be maintained constantly on the instrument to produce the cathode ray, yet the ray itself has to be kept off the photographic plate to avoid blackening. A specially designed tube, made of Jena glass, permits a prolonged bombardment by the electrons without overheating, while an electric four-stage trap deflects the ray during the waiting period. A set of vacuum tubes controls this deflecting device and admits the recording ray to the plate at the instant of the sought disturbance. Since there would still be a noticeable delay, preventing the recording of the very start of the oncoming wave, about 150 m. of cable is interposed, through which the wave has to travel before reaching the oscillograph. This will cause some distortion, but seems to be the only way to give a complete record. A number of constructive details of the latest type of Dufour oscillographs for this type of investigation are given. — *Bulletin de l'Association Suisse des Electriciens*, May 7, 1928.

Totalizing and Remote Metering Methods.—H. S. BAKER.—A résumé of the several methods of securing totalizing and remote metering readings by means of multi-element, graphic meters largely developed by the author, and proved in actual use over a number of years of practical application. The author's experience with the moving weight principle as compared to the spring principle has been stated to involve the following advantages for the former: Greater permanency of zero and of calibration; greater sensitivity to small fluctuations of load; possibility of using more magnified scales, and inherent straight line characteristics between load and deflection. —*Electrical News* (*Canada*), June 15, 1928.

Heat Applications and Material Handling

New High-Speed Steel Made in Induction Furnace.—The advantages realized by the manufacturers of a new high-speed steel through the use of an induction furnace in the place of the previously utilized crucible process have been covered in this article. The results as reflected in the product and in production economy are indicated and two specific advantages have been enumerated. There is no contamination of the steel by gases, fuel or carbon electrodes. Sulphur and phosphorus, enemies of the steel maker, are eliminated to a greater extent than has ever before been possible. Furthermore, there is a violent stirring of the molten metal electrically, which results in a thorough diffusion of the ingredients throughout the entire mass. This gives the steel greater homogeneity.—*Iron Age*, June 7, 1928.

Metallic Arc Welding Electrodes.—J. B. GREEN.—The results of a study of the effect of surface materials upon metallic arc welding electrodes are reported by the author in this discussion, which covers the fundamental theory of arc heat distribution, arc vapor resistance and similar subjects. The character of the arc may be changed by chemical and structural variations in the surface materials. Stability is one such arc characteristic. Two types of stability are recognized, chemical and electrical. Surface materials have a significant influence on the brittleness or ductility of weld metal. They also can be used to control the arc type, four such types being recognized. The in-

fluence of surface materials on the heating of electrodes is another phase of the matter of practical significance. Surface materials may be employed to control both the operating characteristics of the electrode and the resultant weld properties. Among the operating characteristics might be mentioned stability and rate of melting. Among the weld properties are included freedom from blow-holes and tensile strength. These and other practical applications of a comprehensive knowledge of surface materials are cited in this paper.—*Journal of the American Institute of Electrical Engineers,* June, 1928.

Electrophysics, Electrochemistry and Batteries

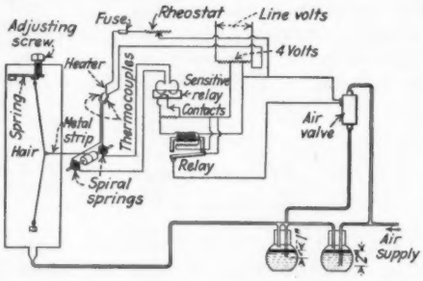
Effect of Heavy Currents upon Strength of Wires.—H. SCHMIDT.—The size of conductors in rotating machines and for transmission lines are calculated with the assumption of a certain mechanical strength and electrical conductivity. If these conductors are subjected to heavy overloads or to excessive currents during short circuits, they may be heated to such high temperature that both of these two characteristics are changed permanently. Originally hard-drawn wire may, for example, become soft and annealed, losing a great deal of its initial strength. While it is known how overheating for at least one-half hour changes the character of copper, bronze, aluminum and some alloys, the effects of heating by many times normal current for only a comparatively very short period, a fraction of one second to a few seconds, have not as yet been studied. Investigations of this nature were made by the author with a special test arrangement. Data on the great decrease of tensile strength of wires are given for more or less momentary heating up to 500 deg. C. As an example it may be mentioned that a hard-drawn copper wire loses 40 per cent of its tensile strength if heated within three-tenths of a second to 500 deg. C.—*Elektrotechnische Zeitschrift,* May 3, 1928.

Improved Method of Visualizing and Photographing the Dielectric Field.—R. H. GEORGE, K. A. OPLINGER and C. F. HARDING.—The need for a more accurate and dependable method of visualizing and photographing the contour and relative intensity of the electric field within insulating media surrounding conductors of various forms is pointed out. Two methods and their necessary accompanying technique are described for accomplishing this. It is stated that such processes, which are free from the possibility of the artificial manipulation so objectionable in earlier methods, may readily be applied in other laboratories with better results than with any other procedure known to the authors. It is suggested that further study of distorted dielectric stresses of varying intensity be made by these methods. Changes that have been found to take place in such stresses are of the nature of a continuously rotating field and should be photographed by means of the motion-picture camera. The authors state that the application of these methods to the analysis of dielectric stresses, too complex for mathematical calculation, will lead to the solution of many puzzling conditions associated with dielectric failure. Such solutions should result in a smaller number of breakdowns of insulation, reduced factors of safety and more economical design and construction of equipment requiring dielectric material.—*Bulletin No. 29, Engineering Experiment Station, Purdue University.*

Compressed Powdered Permalloy.—W. J. SHACKELTON and I. G. BARBER.—The manufacture of magnetic cores of compressed permalloy powder, with particular reference to their use in loading coils, are described by the authors. Production of the powder and its insulation, pressing and annealing are discussed. Under magnetic properties, permeability, core loss and modulation are treated. Curves are given illustrating the characteristics of interest in connection with the design and application of loading coils, and comparisons to corresponding characteristics of compressed powdered iron are made throughout.—*Journal of the American Institute of Electrical Engineers,* June, 1928.

Miscellaneous

Automatic Humidity Control.—An apparatus designed to control the atmospheric humidity in rooms where textile materials, tobacco, paper, etc.,



Schematic arrangement of device for automatic humidity control

are tested or stored or for the seasoning of timber and the preservation of foodstuffs is described in this article. The control is based on the principle of the ordinary hair hygrometer and has been designed to operate electrical relays which govern the supply of dry or moist air necessary to preserve constant humidity in an inclosure. The adjustment of the control to give the required humidity is performed by trial and error in conjunction with a standard hygrometer. This may be done by turning the adjusting screw until the pointer is midway between the two thermocouples when the humidity is at the required value. The control is said to have been used with reliable and satisfactory results.—*Electrician (England),* May 25, 1928.

Modern Cements.—P. H. BATES.—At the present time Portland cement finds itself in the same position relative to a new product, high-early-strength cement, that natural cement occupied about a generation ago relative to Portland cement. The author has endeavored to throw some light on the present status of production and use of standard Portland cement as well as the various other hydraulic cements now commercially available. The latter, which include other types besides the much-discussed high-early-strength cement, are gradually but surely gaining a foothold in the producing and consuming industry. Data regarding the fineness, soundness, strength and results of chemical analyses of various cements commercially available have been included, as has an analytical consideration of white, waterproofed, plastic and special cement.—*Engineering News-Record,* June 7, 1928.

Specifications.—The purpose of this report is to assist in the writing of specifications which will clearly describe the equipment wanted and the performance expected of it under given conditions. It is recognized that inflexible standards cannot be set up to apply in all cases. For this reason no attempt has been made to place any limits on the characteristics of the equipment. It is assumed that the individual is sufficiently familiar with the equipment wanted to determine the necessary details and to place the limits to meet his own particular conditions. A general outline of the standard forms for specifications for evaporators, piping, pulverized fuel equipment and coal handling is included. The forms are intended to be used primarily as a checking list and as an outline of a form to be used.—*Serial Report National Electric Light Association,* May, 1928.

Safe Practices for Construction and Operating Men in Power System Construction and Alteration. — The elimination of accidents, it is anticipated, may be accomplished by the combined efforts of executives and supervisors in providing safe working conditions and of the field men in exercising continuous care over themselves and their fellow employees. The purpose of this report is that of pointing out the causes of accidents and how accidents can be prevented. The discussion includes an analysis and listing of accidents and unsafe working conditions; safety methods and practices now generally recognized as being effective in preventing accidents, and plans for enforcement of safety rules. Among the many factors of practice which are considered under the heading of general conditions are: Barriers, protectors, insulation, clearances, test provisions and protective grounds. Under power stations, rigging and handling, station work, prior to energizing, with initial energizing and with alterations; and inspection, repairs, maintenance and emergencies. Underground and overhead line work methods have been similarly treated. *Serial Report National Electric Light Association,* May, 1928.

Book Reviews

The A-C Commutator Motor

By C. W. Oliver. New York: D. Van Nostrand Company. 280 pages, illustrated. Price, $7.50.

The use of alternating-current networks, renewed activity in electrification of railways, developments in the design of motors and increased economic importance of power-factor correction make the commutator motor of great interest. In this book a very complete theoretical treatment is followed by application studies and the author is to be congratulated on this outstanding book. In this country no recent comprehensive book is available that compares with this and it will supply the demand. The theory of the alternating-current commutator motor is complicated, but Mr. Oliver has followed the brilliant methods developed by Latour and consistently clarifies the mathematical expressions with graphs, test data and explanations.

Chapters are given on commutation, analytical treatment of single-phase and polyphase commutator motors, cascade sets and power-factor correction, and in the second part of the book applications to electric traction, hoists, rolling mills and other industrial uses are discussed. The theory and test data on all types of commutator motors are given and college teachers will find this book a very valuable aid to the teaching of this subject.

As pointed out by the author, an unreasonable prejudice exists against the alternating-current commutator motor because of early designs. It is a very fine motor for use under modern conditions, especially where power-factor correction is of economic importance, and this book should do much to remove prejudice and to show the industry the splendid commutator motors now available.

Erdströme

By F. Ollendorff. Berlin, 1928: Julius Springer. 260 pages, 164 illustrations.

Problems of electrical engineering deal essentially with the laws and the application of current transmission through linear conductors, which can be treated mathematically by common differential equations. Ground currents flow in three-dimensional directions, and their computation requires, therefore, the more complex partial differentiation. It is, perhaps, for this reason that comprehensive data on ground currents are not frequently found in electrical literature. This book is an attempt to fill this want. While the author aims at the utmost physical and mathematical accuracy, many more approximations and assumptions are made than is customary in other branches of electrical engineering. The wide variations in ground resistance defeat great exactness and would only tend to cloud theoretical findings. The book will be an excellent guide to the mathematical approach of any ground current problem, but exact values can only be obtained by introducing concrete data from local measurements. For the same reason the influence of electrochemical factors, largely governed by local conditions, is entirely disregarded. The volume is highly up to date and applies for the first time Heaviside's operational calculus to the solution of ground heating and transient ground radiation.

The Lineman's Handbook

By Edwin F. Kurtz. New York: McGraw-Hill Book Company.

This book is designed to be an easily available source of information on practices and methods pertaining to overhead line construction and maintenance. The text is written in clear and simple English, with avoidance of technical terms as far as possible. Those first principles of electricity and of the electric circuit that are essential to an understanding of overhead line work are adequately treated. Specific attention is given to the various forms of line construction. Chapters are devoted to line materials, equipment protection, control and design, to pole and tower line erection and to inspection, testing and maintenance. Additional chapters on first aid and accident prevention complete the book. Illustrations showing actual conditions help to make the book attractive and its contents clear.

Matter, Electricity, Energy

By Walter Gerlach. Translated by F. J. Fuchs. New York: D. Van Nostrand Company. Price, $6.

The principles of modern atomistics are of interest to all engineers and scientists, for in the atomic investigations now under way lies hope for very practical developments. In this book the present state of atomic theory and experimental investigation is treated in non-mathematical terms and without technical phraseology. It is a book the engineer can read and grasp.

Atomic theory is now undergoing a crisis for the whole mechanical explanation of Bohr is questioned and experimental researches give facts which cannot be reconciled with theory. For example, engineers explain conduction in metals by free electrons under the influence of field forces and look for infinite resistance at absolute zero. Yet recent experiments show practically zero resistance for some metals near absolute zero and show abrupt transition changes as temperature changes. No longer can the engineer use this theory safely, nor can he use the mechanical atomic structure theory of Bohr safely. As a matter of knowledge and perhaps as a matter of contributing to atomistics each alert engineer will profit by reading this splendid book. The range of the contents covers general theory, spectrums, photo-electric effects, X-rays, chemical reactions, resonance and dispersion, emission and absorption and many other very live topics.

Elektrische Fordermaschinen

By Prof. Dr. Ing. E. h. W. Philippi. Leipzig: S. Hirzel. 310 pages, 144 illustrations.

In this revision of the fourth volume of a series dealing with industrial applications of electricity, after briefly tracing the history of electric mine-hoisting, the treatise proceeds with a systematic analysis of the mechanical and electrical problems involved and a discussion of the equipment, such as ropes, drums, sheaves, flywheels, motors and accessories and methods of control.

Liberal use is made of practical examples, worked out in detail. Several important European installations are described, and while the author quite naturally draws on practice on his own continent for illustrations, that is merely an incidental feature and should scarcely detract from the value of the work to the non-European student or practitioner.

Book Note

BERECHNUNG VON DREHSTROM-KRAFTUBERTRAGUNGEN. By O. Burger. Berlin, 1927: Julius Springer. 115 pages with 36 diagrams.

In a terse and thoroughly practical manner, the author presents, in this small volume, mathematical and graphical data essential for the economic dimensioning of high-voltage, three-phase power transmission systems. The treatment of the subject is fully up to date, dealing with voltages up to 400 kv. and hollow cable conductors to minimize corona losses. Numerous practical examples are given in detail to explain the correct use of the general mathematical formulas.

YEAR BOOK, AMERICAN ENGINEERING STANDARDS COMMITTEE, 1928. Published by the American Engineering Standards Committee, 29 West 39th Street, New York City. Paper, 87 pages, 7½x10½ in.

In its Year Book the American Engineering Standards Committee not only reviews briefly the work that it has accomplished during the year 1928 but also explains its method of working and its use of available facilities. There are listed in the book all the projects that on April 15, 1928, had an official status before the American Engineering Standards Committee, including standards that have already been approved and also those publications that are available. There is also listed co-operating organizations, members and sustaining members.

ISOLIERTE LEITUNGEN UND KABEL. By Richard Apt. Berlin, 1928: Julius Springer. Third edition. 235 pages with twenty illustrations.

Every new edition of the German V.D.E. rules is an occasion for a reissue of the corresponding explanations and interpretations. This small size pocket book elaborates on the essential details of insulated wires and cables and contains consequently all necessary information on the subject for manufacturers, contractors and electricians.

News of the Industry

Paris Congress Draws 400 Delegates

Fourteen Nations Represented at International Gathering of Producers and Distributors of Electricity—Lieb Presents Reports for N.E.L.A.

By Cable to the ELECTRICAL WORLD

PARIS was the meeting place on July 5 to 10 of the second international congress of the producers and distributors of electricity (l'Union Internationale des Producteurs et Distributeurs d'Energie Electrique). Four hundred delegates from Belgium, Czechoslovakia, Denmark, France, Great Britain, Holland, Italy, Japan, Poland, Rumania, Russia, Spain, Switzerland and the United States were in attendance. The congress was addressed by André Tardieu, Minister of Public Works, and M. Loucheur, Minister of Labor, and the delegates were received by the President of France, Gaston Doumergue. Gian G. Ponti, director and general manager of the Società Idroelettrica Piemonte, Turin, Italy, presided.

John W. Lieb, vice-president New York Edison Company, was chairman of the power-station session. Mr. Lieb, who, with W. H. Onken, Jr., editor of the ELECTRICAL WORLD, represented the National Electric Light Association, made reports on public relations, electric vehicles, street lighting, electrical accidents and resuscitation. These reports were illustrated with motion pictures ranging in scope from the representation of a modern kitchen to views of the bedrock of Manhattan Island. Literature on advertising and "selling the electrical idea to the public" also formed part of the American reports.

Seven working sessions of the Congress were held.

The program of the international congress as corrected up to June 9, but still subject to extension, included papers on the following subjects: Progress in the construction of large steam generating stations, by delegates from Belgium, France and Italy; purification of smoke from central stations, by delegates from France and Belgium; construction of dams, France and Italy; reliability of service, Belgium, France, Italy and Czechoslovakia; grounding the neutral in low-tension networks, Denmark, France, Italy and Czechoslovakia; grounding the neutral in high-tension networks, Italy, France and Czechoslovakia; controlling the interior installations of customers, Switzerland, France and Czechoslovakia; voltage limitations in underground three-phase and single-phase lines and in overhead high-tension lines with different systems of insulation, Belgium and France; technical conditions governing operation in parallel of central stations, Italy, France and Czechoslovakia; inductive co-ordination of transmission and telephone lines, France, Czechoslovakia and Italy; low-voltage installations (220 volts and 30 volts), France and Switzerland; report of the French commission on lamps; street lighting, Poland, United States, France, Italy and Czechoslovakia; scientific organization of work in great electric groups and associations for production and distribution, Czechoslovakia, France, Italy and Poland; tariffs, especially for reactive energy, Holland, France and Italy; public relations, United States, France, Switzerland and Czechoslovakia; storage-battery vehicles, United States, France and Italy; electrical accidents and resuscitation, United States, France and Italy; report on the systematization of electric service at Rome; legislation, Holland, France, Poland and Czechoslovakia; international statistics, Switzerland, France and Czechoslovakia.

Joint Committee Submits Statement

Utility Representatives Ask at Federal Trade Commission Investigation that Judgment Be Deferred—Hearings Are Adjourned Until September

HEARINGS in the investigation that the Federal Trade Commission is conducting into the public utilities were adjourned at Washington on Friday, July 6, until "some time after Sept. 1," with provision for emergency hearings before that time.

At the final midsummer hearing Josiah T. Newcomb, counsel for the Joint Committee of National Utility Associations, filed a statement in which he asked that judgment on the publicity activities of the public service information bureaus be deferred until the close of the investigation. Mr. Newcomb's statement, which began with an expression of the committee's willingness to waive the question of legality and allow the investigation the utmost scope, was in part as follows:

The examiners and agents of the commission have been given free access to all the files of the associations, not only of the associations themselves, but also of the regional divisions and of the local state information bureaus, which are independent of the associations, but at times co-operate with them. Every witness summoned has promptly appeared, documents called for have been furnished, including books of accounts, correspondence, literature and pamphlets circulated, in fact everything which would show or tend to show the nature and extent and also the particulars of the activities inquired about. That this course has been voluntarily followed is, I believe, a circumstance of significance and importance.

A tremendous volume of testimony and documentary material has been accumulated upon the record. While all of it has been available for the newspaper press, only isolated and scattered portions have in fact been made public through newspaper channels. This is in the nature of things, and the statement involves no criticism either of the officers of the commission, who have made the record, or of the newspaper representatives.

All fair-minded persons will, however, agree that final judgments as to the propriety and value of the activities disclosed cannot rest securely on fragmentary portions of the record which alone can possibly be available to the public at this time. Some actually misleading impressions, I apprehend, have occurred. It was inevitable that this should happen.

No attempt has been made by the associations to secure publicity for those portions of the record already introduced which would, it is felt, to a considerable degree offset at least some of the misleading impressions referred to, or to introduce affirmative evidence showing the nature and extent of the influences, organized and unorganized, hostile to the utilities which it was necessary to combat. It seemed best to adopt the more natural course of awaiting the conclusion of this branch of the investigation and of asking at that time the opportunity of presenting such evidence. . . .

If the utility representatives have been ambitious to broadcast, even in the schools and colleges, what they believe to be correct information concerning the production and sale of electrical service, and to instill what they believe to be correct doctrines in regard to the economics of that service, their work has not been undertaken without cause. In a large measure it has been necessary to offset the activities of professional advocates of the nationalization of industry whose program usually has been to begin with the public utilities, and of proponents of a perhaps milder but quite as devastating an innovation, namely, the deliberate setting up of what is certain to be unfair governmental competition with existing utility service. . . .

It is improbable that the public realizes the extent and volume of the persuasive material, sometimes called propaganda, resulting from the activities of these influences. Yet the offsetting activities of the utility associations can scarcely be correctly appraised without such a realization. At some proper time this picture, I trust, will be made complete in the record of this investigation.

Various instances of the propaganda undertaken by advocates of government ownership were brought forward by Mr. Newcomb.

Before the committee adjourned "lobbying" activities of the Indiana Committee on Public Utility Information during sessions of the State Legislature were described by the manager of the Lafayette Telephone Company, Frank O. Cuppey, who said he had represented that committee during the meetings of the Legislature. Mr. Cuppey stated that he had received $3,500 from the Indiana committee for his work dur-

ing the legislative session of 1927. It was understood, he said, that $2,000 of this amount was to be considered as salary, while $1,500 was allowed for expenses. As a matter of fact, he declared, he had spent approximately the whole of the $3,500 in the interest of the utilities.

Asked if he had found any legislation that he had thought to be adverse to the public utilities, Mr. Cuppey said he had and mentioned as examples measures on tree trimming and those affecting the Public Utilities Commission. He had appeared before the committees of the Legislature in connection with proposed legislation, he said, but had not used any of the money he received from the utilities association for that purpose. He had entertained legislators.

Boulder Dam Investigating Board Appointed

Three Engineers and Two Geologists Selected by Secretary Work and Approved by President Coolidge—None Belongs to Colorado Basin District

THREE engineers and two geologists have been named by Hubert Work, Secretary of the Interior, with the approval of President Coolidge, as members of the commission authorized by the recent Congress to study the feasibility of construction of a dam by the government on the Colorado River either in Boulder or Black Canyon. They are Major-General William L. Sibert of Bowling Green, Ky.; Daniel Webster Mead of Madison, Wis.; Robert Ridgeway of New York, Charles P. Berkey of New York and Warren J. Mead of Madison, Wis.

The five commissioners were selected from several score engineers and geologists at a conference between President Coolidge and Secretary Work. While acceptances of the appointments have yet to be received, it was indicated that those named would be willing to serve. None of the appointees is or has been a resident of the Colorado Basin district or associated with that area. Compensation will be $50 a day and expenses.

The commission is to examine the proposed site of the dam, review the plans and estimates and advise the Secretary of the Interior by Dec. 1, 1928, as to matters affecting the safety, the economic and engineering feasibility and the adequacy of the proposed structure and incidental works.

All the appointees are men of standing. General Sibert retired from the army in 1920 after a long and distinguished service. He constructed the Gatun lock and dam at the Panama Canal and the breakwater at Colon Harbor. Daniel Webster Mead is a veteran engineer and an authority on hydraulic engineering and water power, being a professor of those subjects at the University of Wisconsin. As a young man he was connected with the Geological Survey and formerly was professor of hydraulic engineering at the University of Illinois. He is a member of the A.I.E.E. Mr. Ridgeway has been chief engineer for the New York subways and engineer for the Transit Commission and the Board of Transportation for New York, in addition to being the engineer for the Catskill Aqueduct. Mr. Berkey has been professor of geology at Columbia University since 1903 in addition to being geologist for the New York State Board of Water Supply on the Catskill Aqueduct. Warren J. Mead has been on the faculty of the University of Wisconsin since 1906. He has had a consulting practice in economic and engineering geology for many years.

American Standards Association Forming

New Body Will Succeed the American Engineering Standards Committee and Provide Enlarged Machinery to Meet Growing Needs of Industry

RECONSTRUCTION of the American Engineering Standards Committee to keep pace with the growth of the industrial standardization movement in the United States is now under way, according to an announcement by the committee. The principal features of the reconstruction are the definite federation of national organizations, under the name American Standards Association, in such a way that trade associations interested in standardization may more readily join in the direction of the movement; placing the technical work of approving standards in a Standards Council, and concentrating administrative and financial responsibility in a board of directors composed of twelve industrial executives.

The reorganization has been unanimously approved by the main committee of the A.E.S.C. and is now being voted upon by the member bodies. The action of the committee results from more than a year's intensive consideration of the subject by the main committee and rules committee. The latter was enlarged for the purpose to include a representative of each of the nineteen member bodies desiring representation.

In submitting the plan for the formal approval of the member bodies, William J. Serrill, chairman of the committee, says:

"The ten years' experience of the committee has brought to light certain fundamental difficulties inherent in the old organization. It is the purpose of the reorganization to eliminate these difficulties, to place the operation of the committee on a sound administrative basis, and to facilitate the financing of the work on an adequate scale."

Among the conditions which led to the reorganization are the growth of the trade association movement, together with the predominating position which the trade association is coming to have in the field of industrial standardization, and the increasingly important direct part which the plant executive is playing in the standardization activities within his plant and in the movement as a whole. Recognition of this latter condition is reflected in the make-up of the board of directors, which will control the general administrative and financial affairs of the association. The industrial executives composing this board will be elected on nomination of member bodies and will serve for three years.

Approval of standards and matters of procedure will be in the hands of a Standards Council. The council will be composed of not more than three representatives of each of the member bodies, the councilors also serving for a period of three years.

"The underlying principles of the A.E.S.C. remain unchanged," Mr. Serrill adds. "The basic functions remain completely in the hands of the representatives of the member bodies. The individual members, whether of the board of directors or of the Standards Council, are appointed or nominated by the member bodies, which thus remain the fundamental units in the organization.

"The name American Standards Association is being adopted as more accurately descriptive of the reorganized association, and also because of the misunderstandings and misconceptions which have frequently occurred in connection with the words 'engineering' and 'committee.' The scope of the work is, however, being limited to those fields in which engineering methods apply."

The objects of the association, as stated in the new constitution, will be: To provide systematic means by which organizations engaged in industrial standardization work may co-operate in establishing American standards in those fields in which engineering methods apply, thus avoiding duplication of work and the promulgation of conflicting standards; to serve as a clearing house for information on standardization work in the United States and foreign countries; to further the industrial standardization movement as a means of advancing the national economy, and to promote a knowledge of, and the use of, approved American industrial and engineering standards, both in the United States and in foreign countries, and to act as the authoritative channel in international co-operation in standardization work, except in those fields adequately provided for by existing international organizations.

The revised procedure of the committee, which forms a part of the general reorganization and in which there is much more flexibility than formerly, is already in effect. Under the new procedure a sectional committee may operate autonomously, reporting directly to the A.E.S.C., or it may act under a sponsor as heretofore. "Proprietary" standards are recognized and may be revised within a single organization on condition that it be shown that the

standard is acceptable to the groups concerned—a method particularly applicable to highly specialized fields. In very simple cases approval is based upon the action of a conference followed by written acceptances of the interested groups.

Boston Edison Wins National Advertising Award

To the Edison Electric Illuminating Company of Boston has been awarded first prize by the Public Utilities Advertising Association in a recent national "better copy" contest conducted by the association in which the National Electric Light Association co-operated. This contest included over 3,600 advertisements submitted by 158 public utility companies embracing the entire country and reaching into Canada, Australia and New Zealand.

Presentation of the award was made at the public utilities session during the convention of the International Advertising Association in Detroit Tuesday afternoon. The presentation was in the form of a certificate of award indorsed jointly by the Public Utilities Advertising Association and the National Electric Light Association. The winning advertisement will also be reproduced in an elaborate new advertising book being published by the association.

The theme of the local advertising campaign of which the winning advertisement was the first in a series has been a constructive "tie-up" between the electrical contractor and the Edison company, whereby the householder could be reasonably assured of proper electrical installation as a foundation for proper electrical service. This was built around the keynote of "Rely upon your electrician." The campaign was conducted in newspapers in metropolitan Boston and the suburban territory, and the prize-winning advertisement will be reproduced in July in the Boston dailies. This advertising was prepared by the Boston office of Doremus & Company.

Second place in the electric division of the contest went to the Virginia Electric Power Company, Richmond, Va., and third place to the New Orleans Public Service, Inc.

If You Bind Your "Electrical World," Ask for an Index

THE index to the January-June, 1928, issues of the ELECTRICAL WORLD is now ready and will be sent to subscribers on application to the Circulation Department, McGraw-Hill Publishing Company, Tenth Avenue at 36th Street, New York City. Those asking for it are requested to state their position and company in addition to their name and address.

Washington Boulevard, Detroit, at Night

EACH of the 28 new light standards on Washington Boulevard, Detroit, is 32 ft. in height and carries five General Electric "Novalux" units, 24 in. x 36 in. in size. Every unit is equipped with a 1,000-watt incandescent lamp. Approximately 2,000 lumens per lineal foot of street frontage is supplied, which is twenty times the light previously furnished. (See ELECTRICAL WORLD for July 7, page 33, for further particulars of this installation.)

Cleveland Electric Illuminating's Acquisition

Acquisition by the Cleveland Electric Illuminating Company of the Ashtabula municipal plant, noted on page 84 under "Purchases and Mergers," gives the Cleveland company almost complete control of the distribution of electric light and power in northeastern Ohio. The present Ashtabula plant will be connected with the 59-mile, 132,000-volt transmission line which the company is building from Avon to points in Ohio.

The company already owns a site for a large power plant just east of Ashtabula, but this plant will not be erected as long as present facilities are adequate. The present eastern terminus of the 59-mile power line is at Saybrook, about 10 miles from Ashtabula. In addition to the line connecting the Saybrook plant with the municipal plant, the company will construct another line to furnish power to the large Ashtabula docks. A 33,000-volt circuit already connects Ashtabula with the Lake Shore station of the company. When the new connection is made Ashtabula will have a three-way power tie-up, putting it on a superpower system and giving it two emergency lines.

A ten-year rate agreement has been signed by the company and the Ashtabula Council. The schedule of rates is the same as in Cleveland and the other 125 towns and villages served by the company.

Alabama Power Company Is Building New Lines

Five petitions filed by the Alabama Power Company with the State Public Service Commission ask authority to construct approximately 83 miles of transmission and distribution lines at different points. The routes covered are from Georgiana to McKenzie, 7 miles; from Newton to the Alabama-Florida line, 26 miles; from the company's system to a new substation in Marshall County, 5 miles, and from this substation to Arab, 9½ miles; from the intersection of the Florence-Huntsville Highway and the Wilson Dam road to Rogersville, 24 miles, and from Childersburg north through Harpersville and Vincent, 12 miles.

The company will soon begin distribution of electrical energy in Clarke County, Ala., through the construction of a transmission line south from Linden. Mobile officials of the company announce that the new transmission line should reach Thomasville by the middle of July and Grove Hill by the middle of August. It probably will be completed into Jackson, in the south end of the county, early in October. The power company acquired the local plants at Thomasville and Jackson. There was no plant at Grove Hill. Power for the new line will be supplied from Jordan Dam, on the Coosa River. Another new line of the company in south Alabama, recently completed, extends from Flomaton southwestwardly to Bay Minette.

Year's Hydro Growth in the Dominion

Increase of 11½ per Cent in 1928 by Addition of Well Over a Half-Million Horsepower—All Provinces Share

CANADA'S hydro-electric installations this year will total 550,000 hp. This is the amount of turbine capacity which is being installed in entirely new developments or in additions to existing hydro-electric stations, according to data collected by the Dominion Water Power and Reclamation Service. In comparison with the total installation at the end of 1927 of 4,778,000 hp., the additions being made this year are equivalent to 11½ per cent, a wonderful increase for one year.

How does the rate of increase in consumption of electricity in Canada compare with the rate of installation of water power? The official statistics of output of central electric stations, while not representing the entire output of electrical energy in Canada, at any rate throw some light on this subject. For the first five months of 1928 the output of central electric stations throughout Canada was nearly equal to the output for the first half of last year. The increase for the five-month period was almost 16 per cent, so that consumption of electricity appears to be increasing even more rapidly than the installation of water power.

Leaving aside electricity generated from fuel, which is decreasing in comparison with the total, being only 1¼ per cent in May, the output of electricity generated from water power at central electric stations in Quebec and the three prairie provinces was actually greater for five months this year than for the first six months of last year. In percentages the gains for five months this year over the corresponding period last year are: Quebec, 26.4 per cent; prairie provinces (Manitoba, Saskatchewan and Alberta), 21 per cent; British Columbia, 18.5 per cent; maritime provinces (Nova Scotia, New Brunswick and Prince Edward Island), 11.8 per cent, and Ontario, 3.8 per cent.

These figures would seem to set at rest effectively any doubt there may be as to whether water-power development in Canada is proceeding at a rate inconsistent with the market for energy. In fact, they appear to justify the extraordinary number of hydro-electric undertakings now under way or in prospect, which will when completed within the next few years add 2,000,000 hp. to Canada's electrical supply.

Commissioner Maguire Pleads for St. Lawrence Power

Addressing a meeting in Toronto on July 5, C. Alfred Maguire, a member of the Ontario Hydro-Electric Power Commission, stressed the urgent need for more power development in that province. Ontario, he said, could not only absorb but would require in the very near future 1,200,000 hp. as her share of the power to be derived from the St. Lawrence River. It would be a tremendous handicap to the province if the water was not harnessed as quickly as possible. The annual increase in power demand he put between 75,000 hp. and 100,000 hp.

"We are at our wits' end for power, while the St. Lawrence river is running away millions of dollars," Mr. Maguire declared. "If we don't get the power we shall have to resort to steam." He maintained that the proposed scheme for an all-Canadian development of power on the St. Lawrence was impossible in its rudimentary conception. No engineer could so dam the international section of the river where the power must be developed that the water would back up on only Canadian territory. He likewise scouted the idea that the development would come under the control of an international committee. Under the plans contemplated the American and the Canadian interests would separately own their developments.

Studying Lightning Upon Tennessee Mountain Tops

Junior electrical engineers of the Westinghouse Electric & Manufacturing Company have been assigned to study lightning at Chotah, in the Chilhowee Mountains, southeast Tennessee, where thunderstorms average twenty a month in the summer seasons. According to Vice-President W. S. Rugg, they will be equipped with every scientific device useful in such work—Norinder oscillographs, osisos, klydonographs, cameras and other apparatus—and will spend as long a time on the task as is necessary to get results—whether that be six months or six years. The apparatus will be applied to power lines of the Aluminum Company of America covering a five-mile stretch of rough territory. Especial faith is placed in the Norinder oscillographs, which are held to be superior to existing types.

Typical lightning discharge near transmission line

A Norinder oscillograph will be installed on each side of the highest peak of the Chilhowee Mountains, and two klydonographs will be installed one-half mile from each side of each oscillograph. Surges only a ten-millionth of a second in duration will, it is confidently expected, be recorded on the oscillograph. The klydonographs will record the maximum shock received by the transmission line, the osisos will function as a part of distance finders to record the distance of the lightning bolt from the transmission line, and the cameras will make a picture of any flashes within their range. All the devices are automatic, and approaching storms will be signaled by the ringing of a bell, giving the operators abundant time to get into action. It is hoped by the company that the development of lightning-proof apparatus will be greatly stimulated.

Activities of Federal Power Commission

Surrender of its license by the Lockport and Newfane (N. Y.) Mill Owners' Association has been accepted by the Federal Power Commission. This license covered the diversion of treaty water used on Eighteen-Mile Creek. The water now is available for more efficient use in the plants of the Niagara Falls Power Company. Under the new ruling of the commission, however, the application of the Niagara Falls Power Company for an amendment to its license will not be laid before the commission until complete agreement as to the costs involved shall have been reached with the staff of the commission. In the meantime the Niagara company may not utilize the water.

The Afton (Wyo.) Electric Company has applied for a license covering a small development on Swift Creek. The dam is to be 25 ft. high, creating a reservoir covering 13 acres in Swift Creek Canyon.

The Idaho Power Company has applied to the commission for a license covering a transmission line 9 miles long from a point on the applicant's line to Richland.

The Bedford Pulp & Paper Company of Bedford, Va., has applied to the commission for a license to build a dam and power house on the James River near Snowden, Amherst County, Va., to replace the old Cushaw Dam. The proposed dam would back water up the river approximately 1½ miles. The installed capacity of the project is estimated at 5,000 hp., which will be used by the company in the manufacture of pulp and paper.

That portion of the public that is favorable to the proposed power development at Cumberland Falls, Ky., now is beginning to take a more active interest in the matter. The application for a license covering this project was filed more than two years ago. Propaganda against the project, alleging that the scenic beauty of the falls would be marred, was widely conducted. The army engineers, after a careful examination, recommended the granting of the license under conditions which would allow enough water to pass over the falls at all times to preserve its beauty. Those interested in the project expect early action, as the applicant has recently been called upon for a statement of all pre-license costs.

Purchases and Mergers

Metropolitan Edison Merger Sanctioned —Cleveland Electric Illuminating Takes Over Ashtabula Municipal Plant — Consolidated Gas - Brooklyn Edison Merger Assured

AUTHORIZATION of the merger with the Metropolitan Edison Company of eleven other subsidiaries of the General Gas & Electric Corporation has been granted by the Pennsylvania Public Service Commission. These companies, which have previously been named in this column, are the Ortanna Electric Light & Power Company, Boyertown Electric Company, Annville & Palmyra Electric Light Company, Bernville Light, Heat & Power Company, Berks-Lehigh Electric Company, Birdsboro Electric Company, Hamburg Gas & Electric Company, Topton Electric Light & Power Company, Weisenberg Township Electric Light & Power Company, French Creek Electric Company and Blue Mountain Electric Company. This merger will add 25 communities to the territory served by the Metropolitan Edison Company and include Bally, Bechtelsville, Boyertown, Gilbertsville, Marysville, New Berlinville, New Hanover, Arendtsville, Biglerville, Fairfield, Annville, Cleonia, Palmyra, Bernville, Tulpehocken, Birdsboro, Hamburg, Mertztown, Rington and Topton. By the merger the number of subsidiaries owned and controlled by the General Gas & Electric Corporation will be reduced to 21, in comparison with 44 eighteen months ago.

In accordance with the public vote on April 24 in Ashtabula, Ohio, to sell the municipal light and power plant for not less than $2,225,000, the City Council has approved its purchase by the Cleveland Electric Illuminating Company for $2,356,000. The Cleveland company's bid was the only one received.

There will be no special election at this time at Kinston, N. C., to determine whether or not the municipal electric plant shall be sold. Steps to cancel the election have been taken by the City Council. Charges of irregularities were filed with the Council by an attorney for the Carolina Gas & Electric Company, which had offered approximately $1,400,000 for the plant.

Enough proxies have been received by the secretary of the Consolidated Gas Company of New York to assure the adoption by more than the two-thirds majority needed of the plan to issue additional stock to acquire the Brooklyn Edison Company. The merger, therefore, may now be regarded as accomplished. After formal adoption of the merger plan at the stockholders' meeting next week only the approval of the New York Public Service Commission will be needed to make the combination of the properties effective.

The New York Public Service Commission has granted the petition of the Central Hudson Gas & Electric Corporation of Poughkeepsie to acquire the Red Hook Gas & Electric Company and also the capital stock of the Ducal Realty Corporation, which owns water rights constituting part of the Red Hook company's plant.

The recently formed Rochester Empire Power Corporation has made application to the New York Public Service Commission for consent to acquire all of the outstanding common stock of the New York Central Electric Corporation, operating gas and electric plants in Perry, Warsaw, Dansville and other places in Wyoming, Genesee and Livingston Counties; the Elmira Water, Light & Railroad Company, the Marcellus Lighting Company, the Jordan Electric Light & Power Company, operating in Marcellus, Jordan, Elbridge, Camillus and nearby places, and the Tracy Development Company of Waterloo.

The Morris (N. Y.) Light & Power Corporation has made application to the Public Service Commission for consent to the transfer of its works, franchises and system to the New York State Electric Corporation. The Morris company's territory is in Otsego County.

Three petitions have been filed with the Indiana Public Service Commission, the first asking authority for the Southeastern Indiana Power Company and the Indianapolis & Southeastern Railroad Company to purchase the power property formerly owned by the Indianapolis & Cincinnati Traction Company, the second asking approval of the purchase by the Southeastern Indiana Power Company of the power property of the Indianapolis & Cincinnati Light & Power Company, of Rushville, Ind., and the third asking authority for the Southeastern Indiana Power Company to issue $600,000 in bonds, $400,000 in preferred stock and $200,000 in common stock to finance the transaction. The light and power utility is to be operated separately from the traction line, the former to purchase energy from the Indiana Electric Corporation of Shelbyville and to obtain an emergency supply from Indianapolis. The light and power utility will sell energy to the railroad utility, according to Harvey Harmon, a member of the commission, before whom the hearings were held. During the testimony it was shown that about three thousand patrons have been obtained recently for power and light by purchase of small utilities in several localities.

The Iowa Electric Company of Cedar Rapids has purchased the electric franchises and systems at Walcott, Durant and Stockton which were owned by the Muscatine Lighting Company, a subsidiary of the United Light & Power Company of Chicago. The Iowa Electric Company also purchased the gas plant of the Muscatine Lighting Company in Muscatine, but not the electric plant there.

Purchase of the Otterbein (Ind.) Light & Power Company by the Midland Utilities Company of Chicago is announced.

Missouri Commissioner on Engineers in Valuation

J. H. Porter, engineer and a member of the Missouri Public Service Commission, in a discussion of valuation and the part of the engineer in such work, at St. Louis on June 25, said:

"The Supreme Court of the United States has said truly that valuation is not a thing of rules and formulas. But it can be a thing of principles, and it is up to the engineer to determine those principles and to stop trying to get values by legal precedent, to stop reaching out to throw in a lot of figures and call the results values. Those principles can and should be determined by the engineer. Courts have said that reproduction new less depreciation is a measure of valuation, but we ought to determine what that is. Often there are as many depreciation figures before us as there are engineers testifying. Each group of engineers is honest but with different viewpoints as to what constitutes depreciation in plant. In the issuance of utility securities the Missouri commission has made no hard-and-fast rule, but has placed the maximum bonds at 70 per cent of the physical valuation, the remainder to be taken up by preferred and common stocks. We try to get an even better set-up, but that varies with the companies. It is all based on the physical valuation of the property."

Long Beach Steam Plant No. 3 Has Noteworthy Features

Long Beach steam plant No. 3 of the Southern California Edison Company, which has attracted wide interest because of the size of the turbo-generator, was completed recently. The 94,000-kw. steam turbine driving a 90,000-kw. main unit and a 4,000-kw. generator for auxiliaries is the largest single-shaft unit yet constructed and is the first of eight similar units to be contained in the ultimate plant. The unusually large single-shaft unit was chosen because of the economy effected in construction and operation, and the plant as a whole was designed to secure kilowatt-hours at the lowest possible fuel cost.

A noteworthy fact is that the output of the plant is transmitted at 220 kv., this being the first instance where lines and switching equipment of this voltage have been employed at the seashore. Lowered insulation from sea fogs and the possibility of flashover will be prevented by a high-pressure fresh-water spray system which will direct a jet of water on all insulators and transformer and oil-circuit-breaker bushings. The fresh-water spray will be used with equipment energized and as often as necessary to maintain safe insulation.

The plant itself is designed on the unit basis. There will be three boilers for each turbine with a spare for each of two units. The boilers, 67 ft. in height, are equipped for burning both oil and natural gas, and the furnaces are so designed that with few changes the plant may later be changed over to burn powdered coal. Complete automatic boiler control and automatic speed control will provide close regulation.

Auxiliaries are motor-driven throughout by a generator placed on the shaft of the main unit to take advantage of the higher efficiency of the larger prime mover. A turbine-driven auxiliary generator is provided for emergencies and also to maintain auxiliaries at full speed in case of any system disturbance which might reduce the speed of the main unit. The main generator is provided with four external blowers for circulating cooling air, a feature somewhat new in generator design. The turbine has four single-pass vertical condensers. Cooling water flows up through the tubes with provision for reversing the flow for cleaning

National Fuels Meeting in Cleveland Next Fall

For the second national meeting of the Fuels Division of the American Society of Mechanical Engineers, to be held in Cleveland on Sept. 17-20, a comprehensive program has been planned which will include papers by a representative group of nationally recognized authorities dealing with the production, distribution and efficient utilization of fuel. There will be four papers under the classification "general," three under "fuel characteristics," two under "industrial," three under "marine," six under "power plant," four under "pulverized fuel," four under "railroad" and four under "smoke abatement."

The "power plant" and "pulverized fuel" groups will include the following papers:

Power Plant—"Recent Developments and Improvements in the Baffling of Vertical Boilers," A. O. Danks, Cleveland; "Texas Lignite as Fuel for Power-Plant Boilers," Hal C. Weaver, University of Texas; "Stoker Advantages and Difficulties," Theo. Maynz, Cleveland; "Developments in Recent Design of Stoker-Fired Equipment," J. G. Worker, American Engineering Company, Philadelphia; "Boiler-Furnace Refractories," G. F. Hirshfeld and W. A. Carter, Detroit Edison Company; "Determination of Economic Value in the Selection of Power-Plant Equipment," F. M. Van Deventer, Henry L. Doherty & Company, New York.

Pulverized Fuel—"Progress in Central-Station Use of Pulverized Coal," E. H. Tenney, Union Electric Light & Power Company, St. Louis; "Present Status of Furnace and Burner Design as Affected by the Use of Pulverized Fuel," E. G. Bailey, Fuller-Lehigh Company, Fullerton; "Present State of the Art of Collecting Dust from Chimney Gases in Powdered-Fuel Installations," Kurt Toensfeld, Combustion Engineering Corporation, New York; "Unit System of Coal Pulverizers," John Blizard, Foster-Wheeler Corporation, New York.

Public Utility Commission Engineers Confer

California, Oklahoma, Iowa, Wisconsin, Florida, Alabama, the District of Columbia and two Canadian provinces, in addition to most of the Northeastern states, were represented at the sixth annual conference of state public utility commission engineers held recently under the auspices of the United States Bureau of Standards. Since the questions discussed are treated from the point of view of the commissions rather than in their more general aspects, the proceedings of the conference are not published.

Among the papers included in this year's program were: "Depreciation in Connection with Appraisals," by H. Carl Wolf, Maryland Public Service Commission; "Effect of Reduced Cost of Steam Generation on Development and Potential Value of Water Powers," by C. M. Larson, Railroad Commission of Wisconsin; "Inducement Form of Rate for Residential Use of Gas and Electricity," by C. R. Vanneman, New York Public Service Commission; "Development of Rural Electric Service in California," by A. V. Guillou, California Railroad Commission, and "Fourth Edition of National Electrical Safety Code," by M. G. Lloyd, Bureau of Standards.

Briefer News

STOCKTON, CALIF., CONSIDERS MUNICIPAL OWNERSHIP OF ELECTRIC DISTRIBUTION SYSTEM.—The City Council of Stockton, Calif., has authorized its power committee to prepare a technical survey and appraisal to be presented to the California Railroad Commission looking toward the acquirement of the power distribution system by the municipality. Stockton is served by the Pacific Gas & Electric Company.

ENLARGED FACILITIES AT MINOT, N. D.—Installation of a new steam turbine and other equipment at the Minot (N. D.) power plant of the Northern States Power Company, at a cost of approximately $300,000, is under way. The turbine, according to Charles Cushing, chief engineer, will enable the company to meet increasing demands for service due to the steady growth of the city.

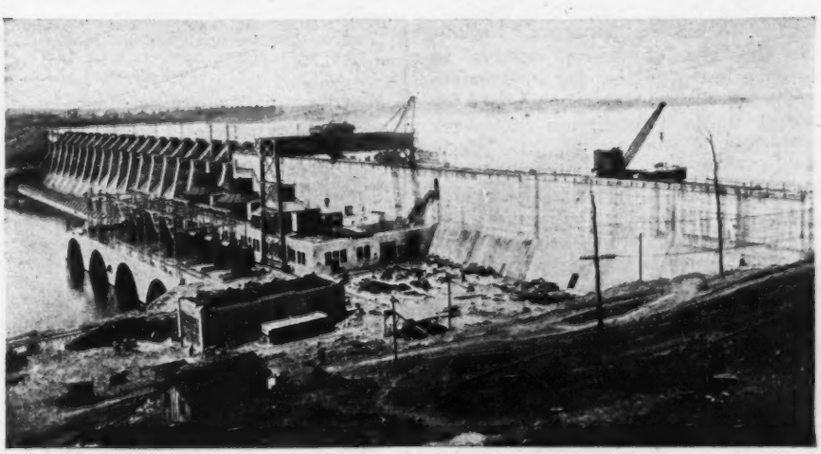
IS IT ILLEGAL TO FURNISH HEAT AND POWER TO DISTILLERY?—Interrogated concerning the action of federal agents in seizing the plant of the Atlantic Coal Tar Distillates Company, Elizabeth, N. J., newspapers having alleged that this was done because it had supplied power to an adjoining factory previously seized which had been engaged in redistilling denatured alcohol, law officers of the Prohibition Bureau at Washington asserted that a power company would violate the law if it were to sell electricity with a knowledge that it was to be used for an illegal purpose. The lawyers denied, however, that any plant had been seized for having furnished power or heat to those engaged in the manufacture of alcoholic beverages. The closing of the plant of the Atlantic Coal Tar Distillates Company, it was stated, was prompted by evidence entirely apart from its having furnished heat and power to the adjoining plant.

ROCKY MOUNT, N. C., TO INSTALL NEW GENERATING UNIT.—The city of Rocky Mount, N. C., has determined to install a new unit in the municipal power plant in place of contracting with the Carolina Power & Light Company for standby power. This decision was made on the recommendation of the electrical engineer who, as recently noted in these columns was employed by the city to recommend the best course to pursue.

BALTIMORE ELECTRIFICATION METHODS STILL DISPUTED.—Many points of difference between Mayor Broening's railroad advisory commission and officials of the Pennsylvania Railroad Company have developed during consultations at Baltimore. The method of electrifying the main tracks through the city still is in dispute, it is said, the company's representatives holding out for overhead wires and the Mayor's commission for transmission lines inside the tunnels. The three ordinances, as revised by the commission, are unsatisfactory to the company, and final action has been deferred until the fall, when further conferences will be held.

STEAM PLANT AT ST. JOHN, NEW BRUNSWICK, WILL BE ENLARGED.—More than $750,000 will be expended on additions to the plant of the New Brunswick Power Company at St. John, according to a statement by the vice-president, William H. Swift, Jr. It has been decided to proceed immediately with the installation of a 7,500-kva. steam turbine unit, with new boilers and auxiliaries. This, with the present plant equipment, will give the company a total generating capacity of about 12,000 kw. at its steam plant in St. John. About

Carolina Power & Light Company's New Plant



THIS hydro-electric generating station, situated on the Pee Dee River in North Carolina, near Mount Gilead, and to be known as the Norwood station, went into commission in June with an initial rating of 82,000 hp. The dam is 1,553 ft. long with a maximum height of 100 ft. The plant was briefly described in the ELECTRICAL WORLD for June 30 (page 1409).

three hundred customers have been added in three months, and the power station output in May was 20 per cent above that for the same month last year.

OREGON COMPANIES CO-OPERATE TO SERVE TERRITORY.—A contract for the purchase of 70,000 kw.-hr. of energy per month has been entered into in Oregon between the People's West Coast Hydro-Electric Corporation and the Mountain States Power Company. A new line from North Bend to Reedsport will transmit the electricity from the Mountain States plant at Marshfield to Reedsport, Gardner, Florence and Lakeside and the People's West Coast company will be able to discontinue the operation of several small plants.

UNITED STATES ARMY BUYS 1,900 ELECTRIC RANGES.—The Quartermaster-General of the United States Army has just purchased 1,900 electric ranges to replace worn-out gas, wood and coal ranges in officers' quarters at fifteen posts in Michigan, Washington, Virginia, Indiana, New Jersey, Maryland, Kansas, Texas, Arizona, New York and Kentucky. In addition a number will be distributed later to the posts of the Philippines, Hawaiian Islands and the Panama Canal Department. These ranges are the most modern and are provided with an automatic heat regulator.

CHAIRMAN GETTLE'S TESTIMONY AT WASHINGTON.—When Lewis E. Gettle, chairman of the Wisconsin Railroad Commission, testified before the Federal Trade Commission in the early weeks of its investigation of the utility industry, he did so as chairman of a special committee of the National Association of Railroad and Utilities Commissioners. A recent reference to his testimony in these columns was phrased ambiguously and might be misinterpreted.

ELECTRICAL INSECTICIDE SAID TO INTERFERE WITH RADIO RECEPTION.—Permission to continue experiments with a high-frequency electrical machine designed to kill insect pests and eliminate the use of poison sprays in orchards, but which is said to interfere with broadcasting, was requested of the Federal Radio Commission last week by Herbert E. Smith of Seattle, Wash. Radio Commissioner Lafount, who is in charge of the fifth zone, in which Seattle is situated, said he would allow the experiments to proceed in the morning hours, when, he thought, radio reception would not be seriously affected.

NEW ENGLAND POWER ENGINEERS ELECT OFFICERS.—V. M. F. Tallman of Charles H. Tenney & Company, Boston, was elected chairman of the New England Association of Central-Station Power Engineers at a recent meeting of that body, Harry B. Stearns of the Cambridge (Mass.) Electric Light Company being made secretary and treasurer. Affiliated with this organization is the power committee of the New England Division, N.E.L.A., which elected officers as follows for the ensuing year: Chairman, A. W. Millikan, New Bedford Gas & Edison Light Company: vice-chairman, T. D. Bond of the Tenney company. The next meeting of these organizations is scheduled for Rockland, Me., Aug. 10.

PROTESTS AGAINST TAXATION MADE BY INDIANA UTILITIES. — Nearly fifty public utility companies in Indiana whose taxation assessments are fixed by the State Board of Tax Commissioners have appealed to the board to reconsider the tentative assessments fixed at the first hearing, and the board has scheduled the cases for rehearing. Among the larger utilities seeking reduced assessments are the Indianapolis Power & Light Company, the Indiana Service Corporation, the Indiana Hydro-Electric Power Company, the Interstate Public Service Company and the Terre Haute, Indianapolis & Eastern Traction Company.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

National Electrical Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Maryland Utilities Association—Braddock Hotel, Braddock Heights, Md., Sept. 7. D. E. Kinnear, 1005 Continental Bldg., Baltimore.

Western Section, International Association of Electrical Inspectors—Cosmopolitan Hotel, Denver, Sept. 10-12. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Illuminating Engineering Society—Toronto, Can., Sept. 17-20. L. H. Graves, 29 West 39th St., New York.

Rocky Mountain District, N.E.L.A.—Hotel Colorado, Glenwood Springs, Sept. 17-20. (With Colorado Utilities Association.) O. A. Weller, Public Service Co. of Colorado, Denver.

Empire State Gas and Electric Association—Saranac Inn, Upper Saranac, N. Y., Sept. 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Sept. 22-28. J. W. Welsh, 292 Madison Avenue, New York.

International Committee on Illumination, Saranac Inn, Lake Saranac, N. Y. Sept. 22-28. (See Illuminating Engineering Society.)

New England Section, N.E.L.A.—Poland Springs House, South Poland Springs, Me., Sept. 24-27. Miss O. A. Bursiel, Statler Bldg., Boston.

Great Lakes Section, N.E.L.A.—French Lick Springs, Ind., Sept. 27-29. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

EIGHTY-FIVE WELDED STRUCTURES ARE LISTED.—A total of 85 welded structures, including 43 welded buildings, are listed by Prof. Frank P. McKibben in the July issue of the *General Electric Review*. The list is made up of 8 bridges, 43 buildings, 3 cars, 2 cranes, 6 frames and towers, 12 ships and allied structures and 11 tanks. Commenting on the list, Professor McKibben says that it "shows that this process is no longer in the experimental stage, but is a means of fabrication so extensively used as to warrant the attention of all structural engineers and architects."

SAND SPRINGS UTILITY TO MAKE MANY IMPROVEMENTS.—Expansions and improvements to cost approximately $500,000 will be made to the properties of the Oklahoma Power & Water Company before next January, according to S. E. Wolff, president. Foremost among these will be enlargement of the power house at Sand Springs and installation of additional machinery. Two new boilers of approximately 1,000 hp. each and new generating capacity of approximately 12,000 kw., will be added. Rebuilding of transmission lines between Sand Springs and Tulsa and improvement of all other transmission lines in the system will be included in the work.

TWENTY MORE TEXAS TOWNS BEING TIED INTO STONE & WEBSTER SYSTEM.—The Western Public Service Company and Gulf States Utilities Company, which are under the executive management of Stone & Webster, Inc., are completing work which will make possible a large development in the territory lying between the Trinity and Brazos Rivers, drawing on the resources of the generating and transmission system that now serves a strip 300 miles long in Texas and Louisiana. Twenty additional towns are being linked with this system, which is being built and operated by the Gulf States Utilities Company, Beaumont. It has installed an additional 37,500-kw. generating unit in the Neches station, where power for the entire system is generated, with standby stations at strategic points and a "tie-in" with the Houston Lighting & Power Company's Deepwater plant.

BRITISH COLUMBIA COMPANY SEEKS HYDRO SITE ON PEND OREILLE.—Development of 80,000 hp. at a site on the Pend Oreille River, officially known as Clark's Fork, in southeastern British Columbia, is proposed by the West Kootenay Power Company in notices filed with the provincial government at Victoria. The power would be used in the smelter and other properties of the Consolidated Mining & Smelting Company at Trail, B. C., which controls the power company. The mining company is at present a large power user. The site is a few miles from the mouth of

the Pend Oreille River, where it flows into the Columbia, just north of the United States boundary. As the river is under reserve, it will be necessary for this restriction to be lifted before the provincial water board can consider the application.

DISASTROUS FIRE IN A VIRGINIA PLANT FOLLOWED BY RAPID RESTORATION OF SERVICE.—Damage estimated at between $200,000 and $300,000 resulted from a fire which followed an explosion in the high-voltage room of the Electric Transmission Company of Virginia, at Pocket, Va., July 9, and was not under control until five rooms of the plant had been burned out. The explosion set off lubricating oil, and this burning fluid saturated the room in which the fire started. The plant is one of four operated by the company, which supplies light and power for many industries and mines in the Norton section of Virginia. A. O. Umstead, general manager at Norton, said that it was expected the plant would be back in commission within a week. Norton and nearby towns were not affected, they being served by a substation at Dorchester.

SHAWINIGAN COMPANY TO SPEND $25,000,000 ON EXPANSION.—Official details of the recent agreement between the government of Quebec and the Shawinigan Water & Power Company respecting the water powers of the Upper St. Maurice River were given by General Manager Julian C. Smith at a special meeting of shareholders in Montreal. Under the terms of the contract the company is obliged to carry out the following conditions: (a) Complete by Jan. 1, 1930, a comprehensive engineering investigation of the whole reach of the river leased and spend thereon at least $100,000; (b) commence construction operations on the first development by July 1, 1930, and have 100,000 hp. developed by July 1, 1933, at a cost of $10,000,000; (c) carry out the succeeding developments so that the fourth will be started by July 1, 1938; (d) spend at least $25,000,000 upon these developments and the necessary transmission lines. Mr. Smith said: "While the government's conditions are exacting, we appreciate they are in the public interest and believe that we shall be able to meet them all to the satisfaction of the provincial authorities." He said the ultimate expenditure might even reach $45,000,000 in ten or twelve years.

ST. LOUIS APPLIES FORMALLY FOR COMMISSION AUDIT OF UNION ELECTRIC'S BOOKS.—Formal request from the city of St. Louis, through City Counselor J. T. Muench, was on July 6 made to the Missouri Public Service Commission to audit the books and records of the Union Electric Light & Power Company and to investigate the power contracts of that company with other companies controlled by the same holding interests. As previously reported, the city contends that it is apparent from the company's own figures that it can make a total reduction in electric rates in St. Louis and for the system as a whole of $1,418,000 instead of the voluntary cut of $706,465 made in wholesale and commercial and industrial rates in St. Louis and on some residential consumers outside that city. It is also contended that the 3.96 per cent depreciation rate on $59,000,000 is far in excess of the company's reasonable requirements. The company opposed the application, contending that the city had made no showing to justify such expense. Decision was reserved.

Recent Court Decisions

OKLAHOMA COURT HOLDS "REASONABLE NET RETURN" DECISIVE FACTOR IN RATE FIXING.—In Horning Light & Gas Company vs. State, an appeal against gas rates fixed by the Oklahoma Corporation Commission, the Supreme Court of the state refused to disturb the commission's decision, declaring that where the evidence fairly shows that a rate fixed by the commission will bring a reasonable net return on the investment that rate must stand. (267 Pac. 235.)*

VALUATION OF FRANCHISES FOR TAXATION.—The Court of Appeals of New York has modified a ruling of the lower court in Central Hudson Gas & Electric Company vs. State Tax Commission. This suit was over the assessment properly chargeable against the company for its special franchise to use various streets and highways in its territory for its wires. The court of first instance held that net earnings should be apportioned according to the relative user of public highways and private rights-of-way, the same length of wire in either case being held of equivalent value. The Court of Appeals, declaring that a special franchise is not to be compared with a private right-of-way, said: "The relator, it is said, runs its wires for many miles over its own private right-of-way. What is meant by its private right-of-way? If it owns the property, this is valuable and can be valued, and its value is neither more nor less because of the fact that a wire runs over it. If it is an easement or a right procured from other private owners, this also may be valued. These values, when ascertained, go to make up the present value of the relator's tangible property, upon which it is entitled under the net earnings rule to a fair return. This return is deducted from the gross earnings before net earnings, according to which the special franchise is to be valued, can and will be ascertained. If the private ways and the user of the private way for the stringing of wires has not been thus valued as tangible property, that is the relator's misfortune. It should have been so valued. In no way, however, can it be considered a franchise, or the stringing of its wires over its own property valued equally with the franchise to use a street. We do not mean to say that this net earnings rule is the only way to value franchises such as these in question. There may be other methods of determining values. We do say that, as all the parties have accepted this rule, the lineal-foot valuation in this instance was erroneous."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

OKLAHOMA COMMISSION INTERPRETS REVOCABLE PERMIT LAW.—The Oklahoma Corporation Commission has denied the application of the Seiling Light & Power Company for a revocable permit, on the ground that the Seiling company does not possess a valid franchise, there being no record that an election was ever held or a franchise ever voted by the people of Seiling to the utility. The commission finds that the utility possesses only a contract executed by the Town Council and holds that "the act conferring jurisdiction upon the commission in connection with the granting of revocable permits declares that the rights attaching to the holders of franchises within the State of Oklahoma to which said act is applicable apply only to those persons and concerns holding existing and valid franchises which they may desire to surrender and secure a revocable permit in lieu thereof."

PUBLIC UTILITY MUST NOT BE OPERATED TO SUBSERVE THE INTERESTS OF OTHER BUSINESS.—A decision made by the California Railroad Commission in a case affecting the Fontana Domestic Water Company was to the effect that a public utility must not be manipulated to serve the interests of other private business. In the case at issue a real estate company and a water company serving its subdivisions were for all practical purposes identical, and there was some indication that the operators of the realty company had in good faith used the utility business to regulate the degree of attractiveness and salability of different parcels of property. The commission held that any agreement between the purchasers of property and a real estate company placing restrictions or conditions on the right to receive the utility service from a water company having close intercorporate relations with the realty company was not binding in any sense upon either the utility or the patrons except as might be specifically provided by the utility's own effective rules and regulations.

OREGON COMMISSION HANDICAPPED IN CASES WHERE RENEWAL OF FRANCHISE IS REFUSED.—Relying upon the powers of franchise control contained in the state law, three Oregon municipalities have signified their intention of warning operators of light and power companies that the extension of franchise privileges will not be granted until certain concessions relative to future rates, rules and practices are forthcoming. In two of these instances no appeal has ever been made to the Public Service Commission for relief, and in the third the municipal authorities merely request that the commission intervene in a proposed investigation. The commission finds itself helpless to act in the event of a denial of a franchise of any utility, since the law limits the jurisdiction of the state in matters involving the granting of franchises and rights-of-way either in county districts or within the corporate limits of municipalities. The law authorizes county courts and municipal councils to express definitely their individual desires as to whether or not a public utility shall establish operating systems on and over public property, but at the same time the act renders it impossible for the commission to intervene without the consent of those agencies having supervision of franchise contracts and privileges.

News About Men of the Industry

Whitney and Frech Elected Vice-Presidents of G. E.

W. R. Whitney, director of the research laboratory of the General Electric Company for the past 28 years, has been elected a vice-president of the company, and T. W. Frech, who has been associated with the National Lamp Works of the company since 1901, has been elected vice-president in charge of the incandescent lamp division. Three of the company's officials have been elected to the newly created office of honorary vice-president. They are J. R. Lovejoy, vice-president and a director, who has been with the company for 42 years; George F. Morrison, a vice-president and director, who has been with it 45 years, and B. G. Tremaine, one of the organizers of the national lamp division of the company.

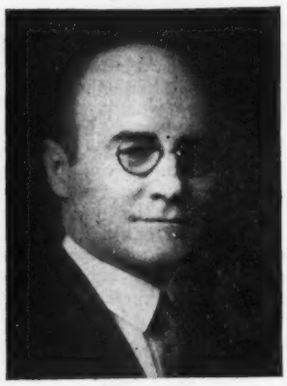
Nicholas Stahl Returns to the East

Nicholas Stahl, well known in the field of central-station engineering, has been appointed manager of engineering and construction for the Pennsylvania Power & Light Company, Allentown, Pa. Following a connection with the power department of the Westinghouse Electric & Manufacturing Company, Mr. Stahl joined the Narragansett Electric Lighting Company, Providence, R. I., in 1918 as general engineer. Nine years later he severed his connection with the Providence utility while holding the position of superintendent of generation to become vice-president in charge of operation of the United Public Service Company, a holding company with offices in Chicago. His connection with the Pennsylvania Power & Light Company ties him in with the largest subsidiary of the Electric Bond & Share Company. Mr. Stahl has been active in the affairs of the National Electric Light Association and is a fellow of the American Institute of Electrical Engineers.

F. E. Schmitt has been appointed editor of *Engineering News-Record*, a McGraw-Hill publication. A graduate in civil engineering of the University of Wisconsin, Mr. Schmitt has been connected with the editorial staff of *Engineering News* since 1902. Early in his career he spent several years as engineer with the Berlin Bridge Company and its successor, the American Bridge Company, before assuming his editorial duties. His achievements in the field of technical journalism have won not only the recognition of his associates but also of the profession and the industry he serves. In addition to his editorial work, Mr. Schmitt has been a valuable factor in the work of several technical organizations, among the more prominent being the American Society of Civil Engineers and the American Society for Testing Materials.

J. C. Matthieu New Vice-President in Dayton

J. C. Matthieu was recently elected vice-president of the Dayton Power & Light Company in charge of commercial development, following a period of service of nearly twenty years. He was graduated in 1907 from the University of Maine with a B.S. degree, and for a short time was connected with the Dean Electric Company of Elyria, Ohio. He relinquished his duties with that company in 1909 to enter the public utility field with the Dayton Power & Light Company, his work consisting of the promotion of electric vehicles. A short time later he became interested in power sales, and he was engaged in this phase of utility work until 1918.



J. C. Matthieu

The rapid growth and expansion of the Dayton Power & Light Company during this period demanded that a strong commercial organization be effected, and Mr. Matthieu was thereupon appointed commercial manager. The announcement of his new official connection with the company followed the consolidation of the Dayton Gas Company with the Dayton Power & Light Company and he now directs all commercial development, both gas and electric.

Mr. Matthieu has been actively interested in the East Central Division of the National Electric Light Association and for two years served as chairman of the Commercial Section. He was the first chairman of the rural electrification committee, and after serving two years in that capacity has continued an active membership in the work of that committee.

F. P. Cummings, a vice-president of the Southeastern Power & Light Company and of the Alabama Power Company with headquarters at Birmingham, has been elected president of the South Carolina Power Company, Charleston, S. C. Mr. Cummings is an all-around utility expert, being thoroughly versed in every feature of management and operation. He has been associated with the Alabama Power organization since 1915, when he became operating superintendent, and since that time he has occupied with distinction the positions of efficiency engineer, commercial manager and vice-president.

Obituary

Edwin Duffey, formerly State Commissioner of Highways, prominent utility official and lawyer, died at his home in Cortland, N. Y., July 3. Mr. Duffey was born in Buffalo, N. Y. 60 years ago. In 1901 he organized the Cortland County Traction Company, serving the company as secretary, treasurer and president. This company was recently taken over by the Mohawk-Hudson Power Company and only a few days before his death Mr. Duffey had been notified of his selection as a director of the Mohawk-Hudson company.

William Pestell, vice-president of the Riley Stoker Company, Worcester, Mass., died suddenly July 9 on a Louisville & Nashville Railroad train when approaching New Orleans, La. He was on a business trip with O. Craig, consulting engineer of the company. Mr. Pestell was widely known in power plant engineering circles and was about 60 years of age. He was formerly master mechanic of the Worcester Consolidated Street Railway and at one time was manager of the Millbury (Mass.) Steel Casting Company. For many years he had been engaged in sales engineering work for the Riley company, with headquarters at New York City and later at Worcester.

Prof. William Esty, head of the electrical engineering department at Lehigh University, died suddenly July 6 in his sixtieth year. He was born at Amherst, Mass., and was educated at Amherst College and at the Massachusetts Institute of Technology. Essentially an educator, Professor Esty had devoted practically his entire career to university work, though he did spend one year with the Thomson-Houston Electric Company at Lynn, Mass. His academic connections included the University of Illinois, from 1893 to 1903, and Lehigh University, where he held the chair of electrical engineering since that time. He was an author of some note on subjects in his special field and contributed frequently to the technical press. Professor Esty was a fellow of the A.I.E.E., a member of the S.P.E.E. and of other similar organizations.

Financial and Statistical News

North American Output Up

Electric power output of the North American Company system for the first half of 1928 totaled 2,730,000,000 kw.-hr., an increase of 13.6 per cent over the output of the same companies for the first half of 1927. As the North American system serves 1,000,000 electric customers and widely diversified industries in Ohio, Missouri, Illinois, Wisconsin, Michigan, Iowa and California, this output is a good indication of business activity in the territories served. Although residence use of electricity shows substantial growth, the larger proportion of the increase is due to greater demand for power for industrial uses. The present output shows an even higher rate of increase over 1927, that for the four weeks ended June 28 having been 441,000,000 kw.-hr., an increase of 17.3 per cent over the corresponding period of last year.

Public Service Corporation Issues Attractive Booklet

In a booklet entitled "Public Service Review—1928" the Public Service Corporation of New Jersey has just issued a historical survey of its organization and growth from the earliest stages to the present time. The report contains 56 pages of text combined with appropriate illustrations in black and white portraying such interesting landmarks as the horse railroad operating between Paterson and Aquackanonk, now Clifton, in 1832, dummies hauling Bayonne cars in 1863, Newark's first central station constructed in 1885 and illustrations of developments of more recent date, such as the Marion electric station, the completion of the Hudson Place Terminal, the opening of the Essex electric station and the formal opening of the Kearney station. The booklet contains, in addition to these interesting historical data, a wealth of statistics covering an analysis of population served by counties, customers served, the growth in volume of electric, gas and street transportation service and the corresponding expansion of plant and equipment. Tables show the increase in operating revenues annually from 1903 to 1927 inclusive, and also the amount of money that has gone into extensions and betterments during that same period.

FRENCH COMPANY REPORTS EARNINGS.—The Union d'Electricité, which supplies electricity to the industrial district surrounding Paris, reports a gross profit from all sources for 1927 of 94,206,977 francs, as compared with 83,331,602 francs in 1926. The statement shows net profit of 23,703,346 francs for 1927, after general expenses, taxes, fixed charges, amortization and transfer of 5,000,000 francs to the contingency fund, as compared with 20,030,741 francs for 1926. The amount available for dividends was 22,518,179 francs in 1927, against 19,029,204 francs in 1926.

VACUUM CLEANER COMPANY PAYS EXTRA DIVIDEND. — The Electric Vacuum Cleaner Company, Cleveland, Ohio, has declared and paid the regular quarterly dividend on the common stock and in addition an extra dividend of $1 per share. The total dividend, which was paid July 2, amounted to $2.

General Electric Orders Increase 16 Per Cent

Orders received by the General Electric Company for the three months ended June 30 amounted to $90,431,957, compared with $78,105,247 for the corresponding quarter of 1927, an increase of 16 per cent, President Gerard Swope has announced. For the six months ended June 30 orders received amounted to $170,357,797, compared with $155,655,828 for the first six months of last year, an increase of 9 per cent.

Excellent Financial Background Shown by Boston Edison

WITH an operating background of more than 40 years, Edison Electric Illuminating Company of Boston stands among the oldest established power and light companies of America. Acquisition, over a period, of a number of smaller operating companies gave the larger company control of service in the important metropolitan area of Boston and the surrounding district.

Last year's progress is typical of Boston Edison's annual growth. Electric operating revenues increased 11.5 per cent, to $25,886,945. Operating costs and taxes expanded by 10.8 per cent, allowing for an increase in net operating revenue of more than 12 per cent. Gross income grew 15.6 per cent, which is substantially larger than the average increase for the industry as a whole.

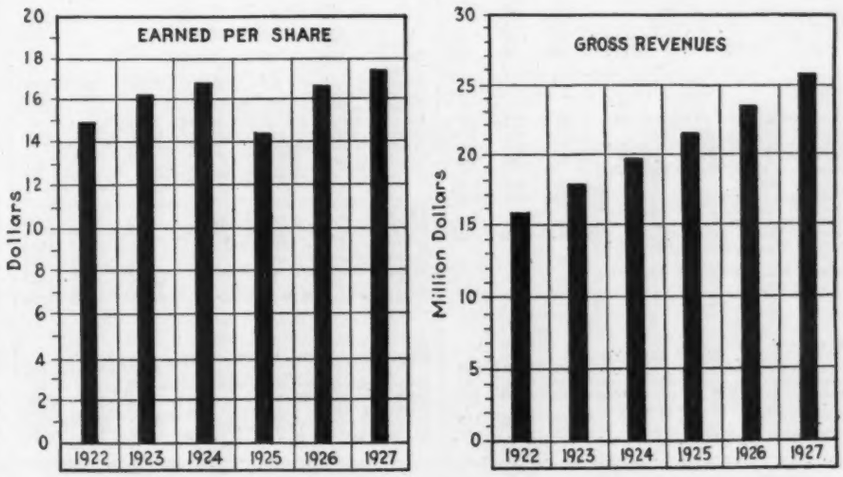
The company's operating position for 1927 also showed substantial betterment over 1926. The operating ratio decreased from 58.1 per cent in 1926 to 56.8 per cent as of Dec. 31, last. After dividends, the amount available for depreciation reserve and surplus increased by approximately 5 per cent to $3,241,901.

Boston Edison's earning record per share is an attractive one. Earnings per share on the $100 par stock for the past six years were as follows:

1922	$14.96	1925	$14.35
1923	16.08	1926	16.64
1924	16.86	1927	17.32

At a current price of around $290, the stock sells at sixteen times earnings, which is lower than the ratio which exists in the case of most comparable companies. In addition to earnings, valuable subscription rights have been offered to shareholders for several years.

Edison Electric Illuminating Company of Boston is regarded as one of the most conservatively managed of the country's large utility projects. Its financial set-up comprises 533,875 shares of $100 par stock and an issue of 4½ per cent gold notes. The stocks pays $12 and is regarded as one of the country's very sound and thoroughly seasoned investment stocks. Plant investment and unfinished construction at the end of last year amounted to about $5.10 per dollar of gross revenue. A substantial



Yearly revenue growth has increased earnings per share steadily

amount of construction has been carried on since that time and this will add materially to earning capacity.

The company's balance sheet as of Dec. 31 last showed total assets of $168,055,941.

OHIO UTILITY AUTHORIZED TO ISSUE STOCK.—The Ohio Public Utilities Commission has authorized the Ohio Power Company to issue $6,333,000 first and refunding mortgage 4½ per cent bonds, at not less than 87, and $2,111,-400 6 per cent preferred stock, to be sold at par. Proceeds are to be used to reimburse the treasury for capital expenditures.

DALLAS UTILITY ISSUES ANNUAL REPORT.—In the annual report covering operations for the year 1927 the Dallas Power & Light Company shows gross earnings of $4,405,844, as compared with $4,041,841 for the previous year, or an increase of 9 per cent. Net earnings amounted to $2,164,486, as compared with $2,034,706, or an increase of more than 6 per cent. Electric power and light consumers of the company at the end of the year aggregated 59,295, as compared with 57,228 as of Dec. 31, 1926, or an increase of about 3 per cent. Generating station output (including purchased power) for the calendar year amounted to 171,926,000 kw.-hr., as compared with 159,430,800 during 1926, representing an increase of approximately 8 per cent.

NEW SECURITIES COMPANY FORMED.—Organization of the Fidelity Union Stock & Bond Company by the Public Service Corporation of New Jersey and the Fidelity Union Trust Company has just been announced. The new company will take over the business of the Public Service Stock & Bond Company and that of the securities department of the Fidelity Union Trust. The capitalization consists of 180,000 shares of $25 par stock, 100,000 of which the Public Service Corporation will subscribe for and the trust company for the balance. J. H. Bachellor will be chairman of the board and Charles G. Colyer will be president. Other directors will include U. H. McCarter, William Scheerer, Edmund W. Wakelee, P. S. Young and Thomas N. McCarter.

Austrian Water-Power Development at End of 1927

Recently published statistics on the status of water-power development in public utility, railway and industrial establishments in Austria show large water power plants of a total mean annual performance of 402,589 hp., turbine capacity of 689,597 hp. and a maximum annual producing capacity of 2,246,100,000 kw.-hr., completed by Dec. 31, 1927. Since the end of 1918 the mean annual performance of large water power plants has been increased 80 per cent, their turbine capacity by 114 per cent and their maximum annual capacity by 75 per cent. In addition to these power plants, installations with a mean annual performance of 95,050 hp., a turbine capacity of 413,160 hp., and a maximum annual capacity of 548,400,-000 kw.-hr. were under construction Jan. 1, 1928.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 10	Low 1928	High 1928
ABITIBI PWR. & PAPER, com. new—no par	62½	57	85
Ala. Pwr., $7 cum. pf.—no par	*m* 114	114½	115½
Allis Chalmers Mfg., 6% com.	127½	115½	129½
Aluminum Co. of Amer., com.	140	120	197½
Aluminum Co. of Amer., 6% pf.	*m* 109	105½	110½
Amer. & Foreign Pwr. 7% pf.—no par	*m* 107	104½	110
Amer. & Foreign Pwr., com.—no par	36½	22½	38½
Amer. Bosch Magneto, com.—no par	33½	15½	41
Amer. Brown Boveri Elec.†	16½	10½	26½
Amer. Brown Boveri Elec., pf. $7	58	40½	65½
Amer. Gas & Elec., 6% pf.—no par	107	101½	111
Amer. Gas & Elec., com.†—no par	163½	117½	184
Amer. Lt. & Trac., 6% pf.	118	116	120
Amer. Lt. & Trac., new com.	230	170	249
Amer. Pwr. & Lt., 6% pf.	*m* 103	102	109
Amer. Pwr. & Lt., com.†—no par	81½	62½	95
Amer. Pub. Serv., 7% pf.	*a* 101	97½	104
Amer. Pub. Serv., com.†	60	...	...
Amer. Public Utilities, 7% ptc. pf.	*m* 90	90	95
Amer. Public Utilities, 7% pr. pf.	102	93½	103
Amer. Public Utilities, com.	*m* 50	...	...
Amer. States Sec., A.	*m* 10	5	12
Amer. States Sec., B.	*m* 12	4½	16½
Amer. Superpower, 6% 1st pf.	*l* 99	...	...
Amer. Superpower, Class A†—no par	38	33½	56
Amer. Superpower, Class B†—no par	38½	35½	56½
Amer. Wtr. Wks. & Elec., 6% pf.	*m* 101½	100	100
Amer. W. W. & E., com. new—no par	59	52	70½
Anaconda Copper cap. $3	68½	53½	74½
Appalachian Electric Pwr., 7% pf.	109	107	110
Arkansas Pwr. & Lt., 7% pf.	106	108	109½
Assoc. Gas & Elec., $3.50—50	51½	...	...
Assoc. Gas & Elec., pf.—$6—no par	97½	96	98½
Assoc. G. & E., Class A, 10—no par	48½	47	52½
BABCOCK & WILCOX, 7% com.	121	117½	128
Binghamton L., H. & P., $6 pf.	101	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf.	*m* 105	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m* 165	135	170
Blaw-Knox com.†	*l* 104	91	108
Brazilian Trac., Lt. & Pwr., com., new	*f* 61	...	...
Broad River Pwr., 7% pf.	102	105	108½
Brooklyn Edison, 8% com.	249	206½	268½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*l* 25½	...	...
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*l* 39½	...	...
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par	*l* 109	109	111
Central & S. W. Util., $7 pf.—no par	*a* 101½	99½	105½
Central & S. W. Util., pr. in. $7 pf.—no par	*a* 105½	103½	112
Central Ark. Ry. & Lt., 7% pf.	105	105	107½
Central Ill. Pub. Serv., $6 pf.	*a* 97½	97½	100½
Central Ind. Pwr., 7% pf.	*a* 97	95	101½
Central Maine Power, 6% pf.	97	96	98½
Central Maine Power, 7%	110	109	112
Central Pwr. & Lt., 7% pf.	106	104½	114
Central States Elec., 7% pf.	113	104	118
Cincinnati Gas & Elec., 5% com.	*g* 100½	97½	100½
Cities Service, $6 pf.—no par	100½	94½	103½
Cities Service, pf. B—no par	9½	8½	9½
Cities Service, pf. BB—no par	95	88½	97
Cities Service, com.—20	66½	54	71½
Cities Service, Bks. Shrs.—10	33	26½	35½
Cities Service Pwr. & Lt., 7% pf.	*m* 105	106	109½
Cities Service Pwr. & Lt., 6% pf.	*m* 99	95	101½
Cleveland Elec. Illg., 6% pf.	*m* 110	110	115½
Cleveland Elec. Illg., 10% com.	425	350	425
Columbia Gas & Elec., 6% pf.	110	106	110½
Columbia G. & E. com. $5—no par	109½	89½	118½
Columbus Elec. & Power, $2 com. no par	*n* 71	66	79½
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 7%	104	107	111
Columbus Ry., Pwr. & Lt., 7% pf. B	103	105	111
Columbus Ry., P. & Lt., com. no par	125	120	125
Commonwealth Edison, 8% com	*a* 187½	165	189
Commonwealth Pwr., 6% pf.	103½	100½	104½
Commonw'th Pwr., $2, com.—no par	75	62½	87½
Conn. Lt. & Pwr., 8% pf.	118	120	123
Conn. Lt. & Pwr., 7% pf.	115	118	121
Cons. Gas of N. Y., pf.	101½	100½	105
Cons. Gas of N. Y., com. $5—no par	150½	119½	170½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf.	*e* 110½	109½	114½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf.	*e* 102½	100	105½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par	*e* 80½	67½	93
Consolidated Power & Lt., 7% pf.	*m* 105	106	109
Consumers Power, 6% pf.	103½	105½	106½
Consumers Power, 6.6% pf.	103½	106	107
Continental Gas & Elec., 7% pr. pf.	105½	106½	108½
Conti. G. & E. com. $4.40—no par	*m* 225	240	265
Crocker Wheeler, com.†	70	...	...
Crocker Wheeler, 7% pf.	97	77	98
DALLAS PWR. & LT., 7% pf	110	110	111½
Dayton Pwr. & Lt., 6% pf.	107½	107	110½
Derby Gas & Elec., 7% pf.	100	96	100½
Detroit Edison, 8% com.	200	166½	209½
Dubilier Condenser, com.—no par	3	2½	5½
Duke Pwr., cap.	*m* 135	130	145
Duquesne Lt., 5% pf.	*m* 100½	100½	116½
EASTERN NEW YORK UTIL., $7 pf.	*m* 110	111	112½
Eastern States Pwr. B.	*m* 18	12	24
Eastern States Pwr., pf.	*m* 100½	98	100½
East. Tex. Elec., 7% pf.	105	106	109
Edison Elec. of Boston, $12 com.	*d* 292	252	305
El Paso Elec. 7% pf.	*m* 111	110	112½
Elec. Bond & Share, 6% pf.	*l* 110	108½	111½
Elec. Bd. & Sh. Sec., com. $1—no par	102½	76	127½
Electric Household Util.†	*a* 23	13½	27
Elec. Investors, 6% pf.—no par	101	101	104½
Elec. Investors, com.†— no par	63	40½	79½
Elec. Pwr. & Lt., ctfs. pf.	107½	106½	110½
Elec. Pwr. & Lt., ctfs., com.—no par	36	28½	45½
Elec. Ry. Securities, com.—no par	6½	...	...
Elec. St. Battery com. $5.25—no par	77	69	84½
Elmira Wtr., Lt. & R.R., 7% pf.	105	104	115
Empire Pwr., ptc.†	35	27½	39½
Engr. Pub. Serv. $5, pf.—no par	*m* 97	97	102
Engr. Pub. Serv., com.—no par	39½	33	46½
Eureka Vacuum Cleaner, com. $4—no par	*m* 65	62½	79
FAIRBANKS MORSE, 7% pf.	108	104	114
F.-M., com.—$3—no par	43½	32½	54
Federal Lt. & Trac., com. $1.40	52½	42	56½
Federal Lt. & Trac., $6 pf.—no par	107	98	109
Florida Pwr. & Lt., 7% pf.	*m* 102	105	108
Ft. Worth Pwr. & Lt., 7% pf.	*l* 113	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	80	75	85
Galveston-Houston Elec., com.	33	31½	38
General Cable, Cl. A	65½	56	84½
Gen. Elec. $3 com.—no par	153	124	174½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.), com. A $1.50 no par	49½	35½	50½
Gen. G. & E. (Del.) pf. A. $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	114	104	117
Gen. Pub. Serv., $7 pf.	98	115	140
Gen. Pub. Serv., com., no par	25	16½	29
General Public Utilities, $7 pf.	*m* 97	98	103
Ga. Lt., Pwr. & Rys., com.	*m* 58	55	65
Gt. Western Pwr., 70% pf.	*h* 104½	...	...
IDAHO PWR., 7% pf.	109	109	111½
Ill. No. Utilities, 6% pf.	*m* 99	96	100
Ill. Pwr. & Lt., $6 pf.	106½	103	107
Indianapolis Pwr. & Lt., 6½% pf.	*m* 104	102	107½
Indianapolis Pwr. & Lt., $7 pf.	101	100	105
Ingersoll Rand com.	*m* 91½	90	98
Int. Combus. Engr., com. $2—no par	63½	45½	72½
Int. Combustion Engr., 7% pf.	103	103	109
Int. Util., Class A—$3.50—no par	48½	44½	52
Int. Utilities, Class B—no par.	16½	6½	19½
Interstate Pwr., pf.—$7—no par	99	99	105
Interstate Pub. Serv., 7% pf.	106	103	108
Iowa Ry. & Lt., 7% pf.	*m* 101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf	103	106	108
Johns-Manville. com. — no par	115	96½	134

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid' price Wednesday, July 11. *m*Bid price Saturday, July 7. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 10	Low 1928	High 1928
KANSAS CITY POWER & LIGHT pf. $7	108½	108½	114
Kansas Gas & Elec. 7% pf.	*l*108½	107	110
Kelvinator Corp.	16¾	11½	22½
Kentucky Hydro-Elec., 7% pf.	*m*103	100	105
Kentucky Sec., 6% pf.	90	90	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	*m*220	200	260
Long Island Ltg., 7% pf.	*m*109	110½	112½
Long Island Ltg., 6% pf.	*m*103	107	109
Long Island Ltg., com.†—no par	*m*250	170	250
Los Angeles Gas & Elec., 6% pf.	*h*108½	105½	112½
Louisville Gas & Elec., cl. A. $1.75	35½	28	41
MAN. ELEC. SUPPLY, cap. $5—no par	57½	50	66¾
Maytag Co., com. 50—no par	*m* 19½	18½	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	104	103	109½
Metropolitan Ed., pf.—$7—no par	108	109	111½
Metropolitan Ed., com. $5—no par	*m*170	125	185
Middle West Utilities, 6% cum. pf.	*a* 96½	93½	100½
Middle West Util., 6% cum. pr lien	*a*102	99	108
Middle West Util., com. $7—no par	*a*146½	123½	169
Midland Utilities, pr. ln. 6% pf.	*a* 95	93	97
Midland Utilities, 6% pf. A	*a* 89½	89½	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*107½	107	109
Miss. River Pwr., 6% pf.	108	94	112½
Mohawk Hudson Pwr., 1st pf.—$7—no par	110	107½	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	104	102½	108½
Mohawk Hudson Pwr. com.—no par	40½	29½	53
Montana Pwr., 5% com.	*m*147	102½	175
Montreal Pwr., com. $2—no par	*f*109½	....	....
Mountain States Pwr., 7% pf.	*m*103	97	105
Mountain States Pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110½
National Carbon, 8% pf.	*n*138	136½	139½
National Elec. Pwr., A†	*a* 33½	27½	42
National Pwr. & Lt., pf. 7%	107½	107	111
National Pwr. & Lt., com.†—no par.	34½	21½	36½
National Pub. Serv., 7% pf.	99	99	104
National Pub. Serv., 7% pfc., pf.	*n*114	....	....
National Pub. Serv., A com. $1.60—no par	26½	22	29½
National Pub. Serv., B com.—no par	*n* 30	24½	32½
Nebraska Pwr., 7% pf.	*l*109	110	111½
Nevada-Calif. Elec., com.	*n* 50	33½	50
New Brunswick Pwr., 4% pf.	*m*60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98½	110½
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	105	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	105	101	107
New York Power & Light 7% pf.	112	....	....
Niagara Falls Pwr., 7% pf.—25	*m* 27½	27½	29½
No. Amer., 6% pf.—50	55	53½	55½
No. Amer., com.—10	72½	58½	78½
No. Amer. Edison, $6 pf.—no par	101½	100½	105½
Northeastern Pwr., com.	26½	19½	31
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	27½	18	32
Northen Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt. & Pr. 6% pf.	*m* 98	94	100
No. States Pwr. (Del.), 7% pf.	109	108½	110½
No. States Pwr. (Del.), 8% com.	136½	123	152
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	19	....	....
OHIO BRASS, com. B $4—no par.	*k* 93	90½	100½
Ohio Brass, 6% pf.	*k*107½	106	108½
Ohio Pwr., 6% pf.	108	104	109½
Ohio Pub. Serv., $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	111	107	112
Ohio River Edison, 7% pf.	107	106	109½
Oklahoma Gas & Elec., 7% pf.	110½	106	115½
PACIFIC GAS & ELEC., 6% pf.	*n* 26	25½	29
Pacific Gas & Elec., 8% new com.	*m* 47½	43½	53½
Pacific Pwr. & Lt., 7% pf.	*l*109	106	110
Packard Electric	*k* 67	47	68½
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 79	78½	82
Penn-Ohio Edison, 6% pf. no par	*m* 95	78	99
Penn-Ohio Edison, 7% pf.	106	104½	109
Penn-Ohio Pwr. & Lt., 7% pf.	106	99	112
Penn Pwr. & Lt.—$7—no par.	*l*109	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 77½	68	80
Phila. Co., 6% pf.—50	*m* 47	45½	48½
Phila. Co., 6% pf.—50	52½	52	57
Phila. Co., com.—50	*m*155	145	174½
Phila. Elec., 8% com.—25	*c* 68½	55½	74½
Portland Elec. Pwr., 7% pf.	103	100	106
Portland Elec. Pwr., 6% pf.	93	78	96
Portland Elec. Pwr., 6% 2d pf.	83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*j*111	....	....
Pwr. Sec., pf.—no par	60	50	68
Pwr. Sec., com.—no par	*n* 13½	11½	14½
Public Serv. of Colorado, 7% pf.,	107	....	....
Pub. Serv. of N. J., 6% pf.	110	103½	115
Pub. Serv. of N. J., 7% pf.	*m*126	118	129½
Pub. Serv. of N. J., $2 com.—no par	56½	41½	66¾
Pub. Serv. of No. Ill., 6% pf.	*m*110	101½	114
P. S. of No. Ill., com. $8—no par	*a*187	159½	190½
Pub. Serv. of No. Ill., $8 com.	*n*185	139½	190
Pub. Serv. of Okla., 7% pr. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	*m*108	107½	110½
Puget Sound Pwr. & Lt., 7% pf.	*m*110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	*m*100	96½	105½
Puget Sound Pwr. & Lt., com.	87	34½	94½
RADIO CORP. OF AMER., $3.50 pf.—50	*m* 56	54½	60
Radio Corp. of Amer., com.—no par.	184½	85½	224
Rochester Gas & Elec. 6% pf. D.	105½	105½	106½
Rochester Gas & Elec., 7% pf. B.	107	105	108
Rochester Gas & Elec., 6% pf. C.	104	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	117	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*m* 75	70	75
Servel, Inc.	13½	4½	17½
Shawinigan Water & Power, com., $2 no par	*f* 96	....	....
Sierra Pacific Elec., 2% com.	49½	29	49½
Sioux City Gas & Elec., 7% pf.	104	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*107	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 87	....	....
Southeastern Pwr. & Lt., com.—no par	52½	40½	61
So. Calif. Edison, 8% pf.	49	38½	53
So. Calif. Edison, 7% pf.	*29	27½	29½
So. Calif. Edison, 6% pf.	27	25½	27½
So. Calif. Edison, 8% com.	49	43½	53½
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3.	65	60	80
Southwestern Lt. & Pwr., B	50	....	....
Southwestern Lt. & Pwr., $6 pf.	93	88	96½
Southwestern Pwr. & Lt., 7% pf.	*m*111	103	115
Standard Gas & Elec., 8% pf.	68½	65	71½
Standard Gas & Elec., 7% pr. pf.	111½	108	115
Standard G. & E., com. $3.50	66½	57½	74½
Standard Power & Light, com.	*m* 50	29½	58½
Standard Pwr. & Lt., 7% pf.	*m*105½	103½	107½
Staten Island Edison, pf.—$6—no par	98	99	103½
Superheater, $6 com.—no par	150	149½	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*m*120	114	121
TAMPA ELEC., com. $2	*n* 65	62	71
Tenn. Elec. Pwr., 6% pf.	100	92	103
Tenn. Elec. Pwr., 7% pf.	107	107	110
Tex. Pwr. & Lt., 7% pf.	*l*113½	113½	115
Tide Water Pwr., 8% pf.	105½	108	112
Timken Roller Bear., com.—$4 no par	122½	112½	134
Toledo Edison, 7% pf.	109½	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*m*105	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	73	70	77
United Gas Impr., 8% com.—50	*c*136½	114½	149½
United Lt. & Pwr., pf.—$4—no par.	*m* 55	49	56½
United Lt. & Pwr., pf.—$6.50—no par	101	95	102½
United L. & P., com. A .48—no par.	26½	13½	27½
United L. & P., com. B .48—no par.	35½	20½	35½
Utah Pwr. & Lt., 7% pf.	*l*107½	109½	112
Utica Gas & Elec., 7% pf.	104½	105	106½
Utica Gas & Elec., 8% com.	*m*200	215	225
Utilities Pwr. & Lt., 7% pf.	99	98	104
Utilities Pwr. & Lt., com. A $2.	40½	28½	45½
Utilities Pwr. & Lt., com. B $1—no par	28½	18½	32½
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	*m*108	108	111
Virginia Public Service 7% pf.	104	97	103½
WAGNER ELEC., 7% pf.	*n*104	96½	107
Wagner Elec., com.—no par.	*b* 79	37	120
Washington Ry. & Elec., 7% com	*j* 450	....	....
Washington Ry. & Elec., 5% pf.	*j* 99½	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 7% pf.	113½	108	115
West Penn Elec., Cl. A $7.	*m*104	103	112
West Penn Pwr., 7% pf.	*m*116	114	118
West Penn Pwr., 6% pf.	*m* 106	103	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	*m*104	100	106
Westinghouse Elec. & Mfg., 8% com. —50	95	88½	112
Weston Elec. Instrument, Cl. A $2 —no par	*m* 33	30½	40½
Weston Elec. Instrument, com.—no par	24½	12½	28½
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A.	*m* 50½	46½	58½
Worthington Pump, 6% B.	*m* 43	41	51
Worthington Pump, com.	32½	28	37½
YALE & TOWNE com. $5—25	69½	68½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, July 11. *m*Bid price Saturday, July 7. *n*Latest quotations available. †Dividend rate variable.

Statistics including water power plants below 500 hp. turbine capacity are not yet available for 1927; figures for the end of 1926 show that at that time 545,000 hp., or 16 per cent of the potential water power of Austria, had been utilized, the total available being estimated at 3,374,000 hp.

Table I presents a summary of developments of 500 hp. or larger at the end of 1927. Table II shows the distribution by industries of the 142,984 industrial horsepower included in Table I. Fuller data are contained in Economic and Trade Note No. 168 of the Department of Commerce, from the American Commercial Attaché in Vienna.

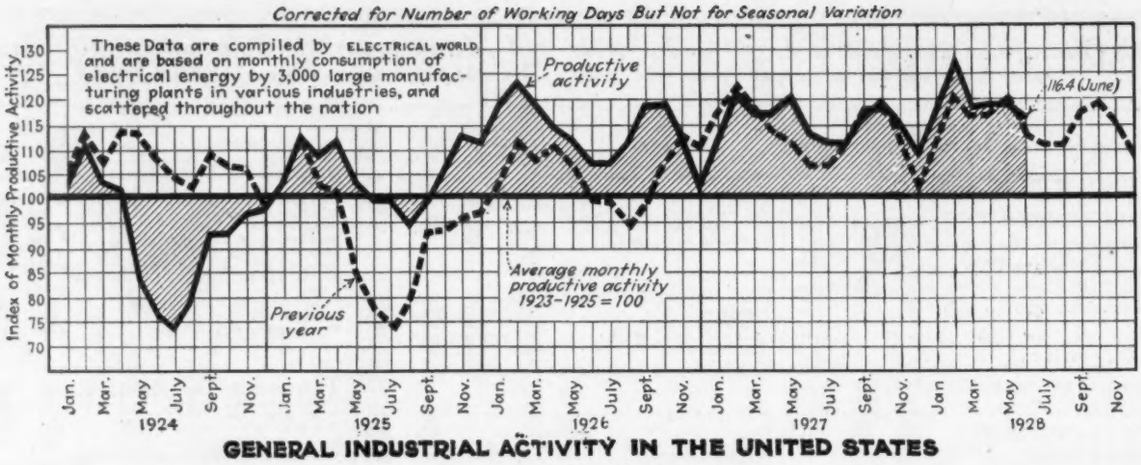
*TABLE I—WATER POWER IN AUSTRIA

	In Plants with Turbine Capacity of 500 Hp.* or More, Dec. 31, 1927		
	Mean Annual Performance, Hp.	Turbine Capacity, Hp.	Maximum Annual Capacity, Kw.-Hr. (Thousands)
Total Austria	402,590	689,597	2,246,100
Of this:			
Public utility plants	242,506	426,585	1,326,200
Railway plants	17,100	48,600	98,700
Industrial plants	142,984	214,212	821,200
Total Dec. 31, 1918	223,634	321,660	1,283,000
Increase 1918–1927, per cent	80	114	75

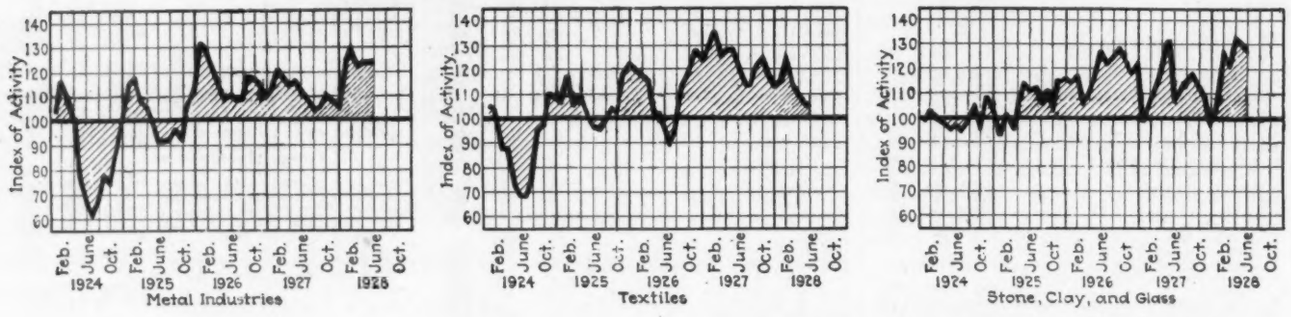
*If several power plants are owned by a single enterprise, smaller power plants are also included, provided their combined turbine capacity is 500 hp. or more.

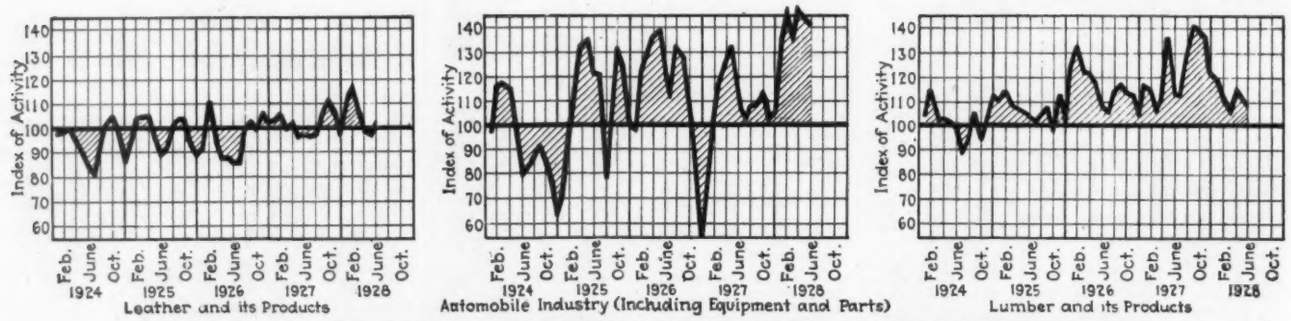
Table II—Austrian Industrial Water-Power Plants, Dec. 31, 1927, by Industries

	Mean Annual Performance, Hp.	Turbine Capacity, Hp.	Maximum Annual Capacity, Kw.-Hr. (Thousands)
Chemical industry	30,628	58,402	177,200
Wood, paper and cellulose industry	49,865	71,363	283,900
Mining, metal and machinery industry	36,541	48,211	210,700
Brick, cement, glass, etc., industry	7,265	10,120	42,100
Textile industry	18,665	26,116	107,300
Total	142,984	214,212	821,200
Total Dec. 31, 1918	110,439	164,276	635,000
Increase 1918-1927, per cent	30	30	29


Corrected for Number of Working Days But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation
Productive activity
116.4 (June)
Previous year
Average monthly productive activity 1923-1925 = 100
Index of Monthly Productive Activity
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES




Index of Activity
Leather and its Products
Automobile Industry (Including Equipment and Parts)
Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

General Industrial Conditions Spotty

THAT general industrial conditions in the nation as a whole are spotty in character at the present time is indicated by data on the monthly consumption of electrical energy reported to the ELECTRICAL WORLD by about 3,000 large manufacturing companies scattered throughout the nation. The first half of the year closed with a rate of industrial operations for the nation as a whole about 3.5 per cent above that witnessed at the close of the same period last year. The month of June, while reporting a seasonal drop in general industrial operations of around 2.2 per cent, did not witness as large a drop in operations as past years would lead one to expect. In several industrial groups the usual seasonal decreases during the past few months have been less than in former years. During the first half of the year the average rate of industrial operations was about 2.8 per cent above the same period in 1927.

That these very favorable general industrial conditions are rather spotty in nature, however, is apparent when comparative operations in the various sections of the nation are brought under consideration. The great industrial sections of the nation, the Middle Atlantic States and the North Central States appear to have concluded the first half of the year on a plane materially above that at the close of the same period last year. The Middle Atlantic States reports a rate of operations during June about 11.3 per cent over June, 1927, and the North Central States were operating on a plane 12.3 per cent above last year. On the other hand, present industrial conditions in the remainder of the nation appear to be somewhat under those at this time last year. June rate of operations in the New England States were about 3.2 per cent under those of last year, the Southern States reported a drop of 4.5 per cent, and the Western States witnessed the largest decreased operations, with 6.2 per cent under June, 1927.

June, 1928	116.4
May, 1928	119.0
April, 1928	119.3
Average first half 1928	119.8
Average first half 1927	116.5

The reason for these wide differences in industrial conditions in the various sections of the nation is made apparent on consideration of the various industrial groups. Textiles, an industry which determines to a very large extent the general industrial conditions of both the New England and Southern States, has been operating on a plane below the same month of the year previous ever since last October. Lumber, which industry also has a very large influence on general Southern conditions as well as Western general conditions, has been operating on a plane under last year since December, with the exception of April. But the automobile industry stands higher.

The index of activity in general industry based on consumption of electrical energy stands at 116.4 for June as compared with 119.0 for May. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are shown in the accompanying table.

Business News and Market Conditions

CONTINUED improvement in the volume of orders for industrial equipment and a fair amount of utility buying are evident. Railroad purchases are an important factor in Pacific Coast activity. A power plant expenditure of $1,000,000 is planned in New England and another of $2,000,000 in the Middle West. Wiring and affiliated work to the extent of $531,000 has been contracted for one building in New Jersey. A Carolina textile mill has let engineering contracts for a $300,000 boiler plant.

For the St. Louis district several good-sized orders have been closed, including more than 400 motors, some electric locomotives and mining equipment. Building construction in three plants is planned for a total of $575,000.

A railroad in the San Francisco district has contracted for standard and miniature lamps of an estimated value of $125,000. A 94-mile line is planned by the same road. Orders for turbine parts feature machinery business. Street lighting expenditures are being made in several cities. Contractors' business is good in southern California. Prices are reported as decidedly lower for small motors, lamps and rubber-covered wire. Motor sales volume included 100 machines for industrial use. New projects include a $1,000,000 chemical plant and a $200,000 bag plant. Other construction works includes $710,000 of building work.

Industrial orders lead in New England and include a 2,500-kw. turbo-generator, a 1,500-kw. unit, numerous switch and control devices, small motors and transformers. Industrial electric furnace orders reached a high peak for the year for one manufacturer. New projects include a $100,000 transmission line and street lighting expansion in three cities.

The Eastern district reports a municipal power development to cost $1,000,000. Industrial equipment is moving to steel and metal-working industries, chemical plants, paper mills and cement mills. Electric refrigerators are selling well. A $350,000 baking plant is planned, as is an expenditure in an airplane factory of $500,000, the latter to conduct other plant expansion to the extent of $5,000,000. A $1,000,000 municipal airport is planned in Pennsylvania.

Middle West and Southeastern conditions are favorable in generally continuing improvement. Building construction for a cold storage plant in Chicago amounts to $2,000,000. A power plant addition of $2,000,000 is planned in Michigan. A sheet glass plant will cost $1,000,000.

Prices Well Maintained for Copper, Zinc and Tin

The hot weather of the last week has made metal sellers and buyers think more of vacations than business, with the result that the total volume of business done has again been well below normal. Prices are in general unchanged, though a weak foreign market, coupled with the lack of demand here, caused a drop in the price of lead in

Value and Destination of Electrical Exports for May, 1928, Compared With Corresponding Month in 1927

Article	May 1927	May 1928
Generators:		
Direct Current:		
Under 500 kw.	$57,797	$110,412
500 kw. and over	3,716	18,578
Alternating current:		
Under 2,000 kva.	23,410	15,354
2,000 kva. and over	250,035	96,601
Steam turbine generator sets	19,331	73,558
Accessories and parts for generators	91,081	106,952
Self-contained lighting outfits	94,619	103,082
Batteries:		
Flashlight batteries	164,645	224,397
Other dry and wet cell primary batteries	230,986	250,130
Storage batteries	315,272	236,515
Transforming or converting apparatus:		
Power transformers	154,880	*
Power transformers, 500 kva. and over	*	91,976
Distribution transformers, less than 500 kva	*	64,145
Other transformers	80,610	*
Instrument transformers	*	19,123
Other transformers, not elsewhere stated	*	81,644
Battery chargers under 15 amp	*	18,479
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	233,548	102,528
Transmission and distribution apparatus:		
Switchboard panels, except telephone	46,138	102,692
Switches and circuit breakers over 10 amp.	144,717	162,626
Fuses and fuse blocks	40,341	37,162
Watt-hour and other measuring meters	15,586	70,158
Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus	152,182	*
Electrical indicating instruments	*	34,440
Electrical recording instruments	*	21,987
Other electrical testing apparatus	*	53,701
Lightning arresters, choke coils, reactors and other protective devices	71,652	82,806
Motors, starters and controllers:		
Motors under 1 hp.	228,613	*
Motors ¼ hp. and under	*	188,555
Motors over ¼ hp and under 1 hp	*	71,302
Stationary motors:		
1 to 200 hp	258,514	219,725
Over 200 hp	53,810	18,340
Railway motors	43,640	136,334
Electric locomotives:		
Railway		287,920
Mining and industrial	25,039	80,283
Station and warehouse electric motor trucks	16,599	28,438
Starting and controlling equipment:		
For industrial motors	87,561	111,621
For electric railway and vehicle motors	19,454	41,528
Portable electric tools	68,236	103,126
Accessories and parts for motors	230,731	203,899
Electric appliances:		
Electric fans	128,769	76,342
Electric lamps:		
Metal filament	166,490	97,259
Other electric lamps	29,024	34,232
Flashlights	211,965	247,074
Searchlights and projectors	115,995	35,248
Motor-driven household devices:	197,525	*
Electric vacuum cleaners	*	220,624
Other motor-driven devices, except tools	*	106,157
Electric flatirons	116,925	*
Domestic heating and cooking devices:	*	26,498
Electric cooking ranges	*	19,226
Other domestic heating and cooking devices	*	75,490
Industrial electric furnaces and ovens	12,252	30,614
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	152,624	120,685
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	15,675	64,899
Receiving sets	141,080	172,274
Tubes	81,098	88,130
Receiving-set components	165,471	178,220
Receiving-set accessories	202,909	130,063
Telegraph apparatus	100,688	72,689
Telephone apparatus:		
Telephone instruments	29,776	34,877
Telephone switchboards	95,663	82,068
Other telephone equipment	281,929	213,713
Railway signals, switches and attachments	35,494	55,028
Bells, buzzers, annunciators, and alarms	23,169	28,751
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	161,047	*
Spark plugs	*	68,860
Other starting, lighting, and ignition equipment	*	119,221
Insulating material	99,640	120,314
Metal conduit, outlet, and switch boxes	125,076	157,426
Sockets, receptacles, and lighting switches	166,217	176,846
Electric lighting fixtures, interior and street	187,422	*
Electric interior lighting fixtures	*	158,345
Electric street lighting fixtures	*	44,290
Other wiring supplies and line material	124,825	78,868
Other electrical apparatus not elsewhere stated	736,071	832,556
Rubber and friction tape	45,948	50,339
Globes and shades for lighting fixtures	50,730	49,540
Electrical glassware except for lighting	17,836	21,605
Electrical porcelain:		
For less than 6,600 volts	64,781	85,336
For 6,600 volts and over	48,903	54,418
Carbons, carbon brushes, and electrodes:		
Electrodes for electric furnaces	146,061	192,894
Other carbon products	84,868	75,757
Insulated wire and cable (iron or steel)	18,983	25,496
Copper, bare wire	188,307	196,372
Copper, insulated wire and cable	671,017	426,190
Refrigeration sets up to 1 ton capacity	386,170	781,864
Domestic washing machines	156,722	191,166
Totals	$9,007,888	$9,850,961

* Changes in classification provide no comparable data

NEW YORK METAL MARKET PRICES

	July 3, 1928 Cents per Pound	July 11, 1928 Cents per Pound
Copper electrolytic	14.525	14.525
Lead, Am. S. & R. price	6.30	6.20
Antimony	9.50	9.50
Nickel, ingot	35	35
Zinc spots	6.55	6.55
Tin, Straits	46.125	46.25
Aluminum, 99 per cent	24.30	24.30

Base copper wire price July 11, 1928, 16½ cents.

New York to 6.20 cents, after 6.30 cents had been maintained for many weeks.

The situation in copper is entirely unchanged, with producers a unit in offering metal at 14¾ cents in the East and at 14⅞ cents for deliveries in the North Central States. All are so well sold up with, and even ahead of, production that they are not seeking business and only quoting on such inquiries as come to them. Practically all of the orders have been for either July or August delivery, no interest being observed in September, though a fair quantity for that delivery was purchased in the last buying wave.

The volume of zinc sales has been well below that of the last two or three weeks, but the price continues steady at 6.20 cents, St. Louis, for July shipment. August is nominally 6.25 cents, but this price seems untested on actual business.

Industrial Equipment Sales Lead in New England

Orders for industrial equipment indicate a better tone in New England. In southern Connecticut an order for a 2,500-kw. turbo-generator was received from a prominent manufacturer; a 1,500-kw. unit was placed by a textile concern in southern Massachusetts, and other negotiations are under way for turbo-generators. Orders for switch and control apparatus are numerous. One for equipment amounting to $5,000 was received, while several smaller orders for replacement and expansion of power installations are noted. Activity among the shoe and refinishing mills is promoting sales of control equipment in small lots. Small-motor sales are steady, and a number of large motor orders were received calling for 50 hp. and 75-hp. capacities. Transformer sales are steady and central-station supplies are in good demand, while crossarms, poles and wire moved well and car shipment lots are recorded for several points in northern New England. Industrial electric heating furnace orders reported by one manufacturer reached the highest peak so far this year during the past month. Street electric lighting projects are pending in a number of localities. Appliance sales show an encouraging gain and flatirons lead, with an active trend in ranges and refrigerators. New projects are as follows:

Street-lighting expansions in Randolph, Amesbury and Lexington, Mass. The L. H. Hamel Leather Company, Haverhill, Mass., will erect a factory, to cost $100,000. A transmission line, 75 miles long, from Ayer Island station to Garvin's Falls station, will be built by the Public Service Company of New Hampshire. Springfield, Mass., plans a power plant on the Little River, to cost $1,000,000. The Bureau of Yards and Docks, Washington, D. C., is asking bids for an air compressor of 5,000 cu.ft. per minute capacity for the navy yard at Portsmouth, N. H. The Blackstone Valley Gas & Electric Company, Pawtucket, R. I., plans an addition to its equipment storage and distributing plant to cost $30,000. The Rockville-Willimantic Lighting Committee, Rockville, Conn., plans an ornamental lighting system.

Buying Reasonably Good in Southeastern States

Central-station companies in the Southeast are buying in reasonably good volume, but no individual orders of moment are being placed. A power company in Alabama has ordered power transformers amounting to $55,000, while companies in Tennessee and South Carolina have ordered this same equipment to the extent of $5,000 each. A Georgia company's purchases of bare and weatherproof copper wire amounted to $17,200. There is a noticeable pick-up in the sale of distribution transformers, though the individual orders average about $2,500 to $3,000 each for this equipment.

There is considerable activity in the industrial field. A paper company in Alabama ordered a 7,500-kw. turbine, amounting to $115,000, and a rayon plant in Georgia placed orders for boiler and stoker equipment totaling $75,000. A textile mill in North Carolina has let engineering contracts on a $300,000 boiler plant which will be an addition to its present power plant, but no equipment orders have as yet been placed. A terminal company in Georgia ordered lighting fixtures totaling $1,000 for the relighting of offices in the terminal station. An order for $25,000 worth of "white-way" equipment and two carloads of rigid conduit was placed for use in connection with the new viaduct construction in Atlanta. Construction projects are as follows:

The Alabama Power Company, Birmingham, plans an automatic substation, near Holt, Ala., and extensions in transmission lines to cost $40,000. Paducah, Ky., plans a municipal electric light and power plant. The Kentucky Utilities Company, Louisville, plans hydro-electric plants at four government dams on the Kentucky River and will build transmission lines, all to cost $650,000. Linker Brothers, Louisville, Ky., plan a baking plant to cost $115,000. The N. & W. Overall Company, Lynchburg, Va., will build a factory at Jackson, Miss., to cost $100,000. The Duke Power Company, Charlotte, N. C., will build a power plant at Mount Holly, N. C., to cost $200,000. Tarboro, N. C., plans a municipal electric light and power plant to cost $100,000. The Bedford Pulp & Paper Company, Bedford, Va., plans a hydro-electric plant on the James River. The Virginia Electric & Power Company, Richmond, Va., will build a substation near Quantico, Va. The People's Ice & Storage Company, Roanoke, Va., plans an ice plant to cost $100,000. The Virginia Woolen Company, Winchester, Va., plans a unit to cost $100,000.

Business Continues Favorable in Eastern District

Central stations and industrial plants are making purchases of electrical equipment in the Eastern district. A utility in northern New York has placed an order with a leading maker for two 5,000-kva. waterwheel generators, as well as for several transformers, the order totaling $120,000. A western Pennsylvania manufacturer has secured a contract from a southern central-station company for four generating units, each of 32,500 kw. rating, for a hydro-electric installation in South Carolina, and two additional such units are expected to be ordered at a later date. The complete development will cost $15,000,000. A western manufacturer has taken a contract from a New Jersey municipality for a new generating unit for a power station at a price of $28,688. A city in Massachusetts plans a municipal power development to cost $1,000,000 and to be operated under the direction of a central-station company. Switching equipment is experiencing a fair but somewhat spotty demand. An Albany central station has placed an order for apparatus of this kind at a cost of $30,000.

Electrical equipment for industrial service has immediate and future promise for sizable turnover. A number of important branches of activity continue with good demand, including steel and metal - working industries, chemical plants, paper mills and cement mills. A steel company at Kansas City, Mo., has placed a commitment with a Pennsylvania manufacturer for complete equipment for a new unit, to cost $100,000. A metal-working plant at Troy, N. Y., has given an order to an Eastern maker for industrial motors and accessories to cost $20,000. Several printing plants in the New York metropolitan district have been active purchasers of control apparatus, and there is a promising summer market ahead for equipment of this kind for different industrial consumption. The United States Navy has been a good buyer of control apparatus recently and further business is anticipated from that quarter.

Wire and cable account is of reduced proportions, although the outlook gives fair promise. A contract for wiring and affiliated work for a $10,000,000 municipal convention hall at Atlantic ity, N. J., has been given to a New York company at a figure of $531,000. Electric refrigerators are enjoying an excellent market; a prominent Eastern manufacturer of such units reports capacity production at a group of plants, with total shipments aggregating more than 2,000 carloads during the past 90 days. Immediate construction activities in the Eastern district include the following:

The Cortland County Traction Company, Cortland, N. Y., will make extensions in transmission system for service at Virgil and vicinity. Cushman Sons, Inc., New York, plan a baking plant at White Plains, N. Y., to cost $350,000. The Sylvestre Oil Company, Mount Vernon, N. Y., will build

a storage and distributing plant to cost $100,000. The Westchester Cleaners & Dyers, Inc., Mount Vernon, N. Y., will build a factory group to cost $110,000. The Wright Aeronautical Corporation, Paterson, N. J., plans additions to cost $500,000 and will carry out other plant expansion to an amount of $5,000,000. The North Jersey Sand & Stone Company, Spring Lake, N. J., plans extensions in sand and gravel producing and distributing plant at Carpentersville, N. J., to cost $75,000. Havana, Cuba, has authorized plans for an ornamental lighting system on the Prado, comprising ten city blocks. The Reading Railway Company, Philadelphia, will build a substation, to cost $50,000. The Atlantic Refining Company, Philadelphia, plans an oil-refining plant near Port Neches, Tex., to cost $400,000. The Lehigh Valley Cold Storage Company, Bethlehem, Pa., plans expansions in its ice plant to cost $200,000. Reading, Pa., plans extensions in the municipal waterworks to cost $1,000,000. The County Commissioners, Pittsburgh, are considering a municipal airport to cost $1,000,000, with complete beacon lighting system for night landings. The Duquesne Light Company, Pittsburgh, plans expansions at Midland, Pa., and vicinity to cost $25,000. The General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until July 27, for a motor-generator set, transformer, frequency-recording meter, outdoor metering outfits, etc. (Panama Schedule 1887).

The Board of Awards, City Hall, Baltimore, Md., will receive bids until July 18, for electric wiring and fixtures for public schools.

Railroad Purchasing Active on Pacific Coast

The past week has been featured by railroad purchasing, actual and projected, on the Pacific Coast. The Southern Pacific awarded its lamp contract for the fiscal year of 1928-29 to the General Electric Company, the estimated value being $125,000 in standard and miniature "Mazdas," of which $75,000 worth are used in the San Francisco territory. Two big jobs about to be begun by the same road are a 97-mile line between Klamath Falls and Alturas, for which four copper wires will be strung, and the main-line bridge over Carquinez Straits, requiring an estimated electrical installation of about $75,000. Power-company buying has been quiet except in electric ranges, heavy-duty heaters and appliances. The East Bay utilities intend to build a 15,000-kva. plant on the Mokelumne River. Orders for turbine parts feature the week's machinery business, one manufacturer reporting an aggregate of three lots, sizes 1,500 kva. to 2,500 kva., valued at $30,000. Street-lighting business is largely extension work by the larger cites. It includes 273 tops and transformers, valued at $20,000, for Stockton; 128 units for Oakland and 72 for Sacramento. The smaller cities of Sunnyvale, Madera, Oroville and Los Banos are now planning installations, the last named requiring 91 standards. Los Angeles intends to construct a $1,500,000 building and to vote a bond issue for the construction of the Los Angeles county court house. Contractors' business in California is good in the southern part of the state and very fair elsewhere. Dealers' business is proportionate. Prices are decidedly lower, such staples as small motors, lamps and rubber-covered wire having dropped from 5 per cent for the wire to 15 per cent for the motors.

In the Northwest motor and apparatus sales, which have been lagging, show slight improvement, with indications of good business later in the summer and early fall. Motor volume included approximately one hundred machines, mainly in small sizes, for cold-storage plants, irrigation, lumber-mill replacements and industrials. The largest orders reported placed were for an addition to the pulp and paper plant at Tacoma and for a lumber mill in eastern Oregon, these orders involving motors from 100 hp. down to about 20 hp. A report that the General Electric Company has secured an award for about 300 general-purpose motors, costing between $75,000 and $80,000, from the Weyerhaeuser Timber Company at Longview remains unconfirmed. New projects include a $1,000,000 chemical plant in Tacoma and a $200,000 bag plant in Vancouver, Wash. Construction projects are as follows:

The Western Electric Company, New York, N. Y., plans a factory at Emeryville, Calif., to cost $450,000. The Modesto Irrigation District, Modesto, Calif., plans two substations to cost $60,000. The Holly Sugar Corporation, Tracy, Calif., plans an addition to cost $100,000. Idaho Falls, Idaho, has approved a bond issue of $100,000 for a municipal hydro-electric plant on the Snake River. The Buffalo Northwestern Electric Company, Buffalo, Wyo., plans a steam-operated power plant to cost $40,000. Tucson, Ariz., Madera, Visalia, Sunnyvale, Los Banos, Los Angeles and Berkeley, Calif., and the Keystone Improvement Company, Woodland, Calif., plan ornamental lighting systems.

Orders of Good Size Closed in St. Louis District

Several good-sized orders which were being figured on in the St. Louis district were closed. An order was placed for more than 400 motors from ¼ hp. to 50 hp. in rating and for a number of circuit breakers, all aggregating $65,000. Five electric locomotives for an Illinois coal company, costing $30,000; nineteen centrifugal air compressors for a lead-mining company, costing $25,000, and 65 street-car air compressors, to cost $25,000, were other items. A miscellaneous lot of motors for an industrial concern, costing $4,500; another lot of motors for a manufacturing company, costing $5,000; six motors of 50 hp. rating for attachment to power shovels on unloading machines, costing $3,000, and a switchboard for the western part of the district costing $17,000, are also reported. Small orders are coming in in good volume, fans being particularly active. Construction projects are as follows:

The Century Electric Company, St. Louis, will build an addition to cost $125,000. The South Texas Compress Company, Galveston, Tex., plans an addition to cost $100,000. The Moody Corporation, Esperson Building, Houston, Tex., plans an oil refining plant to cost $350,000. The Central Power & Light Company, San Antonio, Tex., will make extensions in the lighting system at Flatonia, Tex.

The Board of Public Service, 208 City Hall, St. Louis, will soon take bids on extensions to the electric street-lighting system to cost $750,000.

Industrial Activity Is Increasing in Middle West

Business in the Middle West continues to improve. Industrial activity is gaining somewhat, and recent reports from the steel industry indicate an increased schedule of operations. The automotive industry is continuing its production schedule, and both of the large mail-order houses report substantial increases in their volume of business, indicating a good demand originating in the agricultural sections. A large amount of underground construction work is going on in the Chicago district. Recent electrical storms have increased maintenance work and a considerable amount of maintenance purchasing is being done. One interesting order placed was for complete control equipment for pulverizer-mill motors complete with appurtenances. Jobbers' sales are normal. The General Electric Company reduced the price of motors approximately 10 per cent and established a new sales schedule effective July 2. Construction projects are as follows:

The Produce Terminal Cold Storage Company, Chicago, plans a cold-storage plant to cost $2,000,000. Woodstock, Ill., will receive bids until July 20 for a 1,350-kw. turbo-generator, one condenser, pump, cooling tower, switchboard and accessories. Hartsville, Ind., plans an electric lighting system and a transmission line. The Interstate Public Service Company, Indianapolis, Ind., will build a substation at Shelbyville, Ind., and will make extensions in transmission lines. The Major Brothers Packing Company, Mishawaka, Ind., plans a plant, to cost $600,000. The Syracuse Electric & Telephone Company, Syracuse, Ind., plans an equipment storage and distributing plant. Emmetsburg, Iowa, is arranging a franchise for the Municipal Utilities Company, Des Moines, Iowa, to construct and operate an electric power plant, to cost $100,000. The Board of Education, Ishpeming, Mich., is planning a central power plant. The Kalamazoo Stationery Company, Kalamazoo, Mich., plans a power plant at its factory to cost $50,000. The Consumers Power Company, Jackson, Mich., will build an addition to its steam-operated electric power plant at Zilwaukee, Mich., to cost $2,000,000. The American Wood Products Company, Minneapolis, Minn., plans a plant to cost $100,000. The Otter Tail Power Company, Fergus Falls, Minn., will build transmission lines for service at Tuttle, Wilton, Mooreton, N. D., and vicinity. The State Department of Public Welfare, Columbus, Ohio, will receive bids until July 17 for a power plant and equipment at the Cleveland State Hospital. The Board of County Commissioners, Springfield, Ohio, will build an addition to the power plant at the Clark County Children's Home. The Libby-Owens Sheet Glass Company, Toledo, Ohio, plans a group of plants, at an estimated cost of $1,000,000.

Activities of the Trade

General Electric Subsidiary Goes to Industrial Acceptance

The entire capital stock of the General Contract Purchase Corporation of New York, installment financing subsidiary of the General Electric Company, has been acquired by the Industrial Acceptance Corporation, according to a joint announcement yesterday by Gerard Swope, president of the General Electric Company, and Arthur J. Morris, president of the Industrial Acceptance Corporation.

Arthur J. Morris will be chairman of the board and Percy M. Hall chairman of the finance committee. E. W. Miner, who has been president of the General Contract Purchase Corporation, continues as president and general manager.

Commenting on the deal, Mr. Swope said:

The General Electric Company for more than seven years has been financing time installment sales of electric products in which General Electric apparatus has formed a part, and this service has grown to such an extent that at the end of 1927 General Electric had advanced more than $16,000,000 to its subsidiary financing companies. Over the period of operation more than 800,000 contracts amounting to upward of $114,000,000 have been financed.

It has long been recognized that this business requires special treatment and by an organization that is skilled and experienced in this specialized field of banking. After study and consideration the directors of the company decided to dispose of the capital stock of its financing subsidiaries to the Industrial Acceptance Corporation.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, manufacturer of electric instruments and circuit breakers, announces that John A. Coleman, 1006 Washington Avenue, Houston, Tex., has been made representative for Texas, and H. T. Weeks, U. S. National Bank Building, Denver, Colo., will represent the company in the states of Colorado, Utah, Wyoming and northern New Mexico.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, manufacturer of transformers and automotive cables, announces that W. D. Hampton has joined the Atlanta branch as assistant to A. R. Pierson, who has succeeded S. A. Redding, district manager of that office.

THE CHICAGO-JEFFERSON FUSE & ELECTRIC COMPANY, 1500 South Laflin Street, Chicago, announces the following changes, additions and promotions in the sales department: L. E. Fuller has been promoted from district sales manager to Western sales manager, G. A. Shaver has been promoted from salesman to Pacific Coast sales manager, J. D. Benfield is assigned to the western New York and northwestern Pennsylvania territory, S. V. Evans is assigned to the eastern New York territory, E. Duffy to Wisconsin and upper Michigan, A. J. Olson to the north side of Chicago, E. G. Schmitt to western Ohio and southwestern West Virginia, E. A. Abbott to Oklahoma and Texas, and H. R. Hosmer to Louisiana and Mississippi.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Conn., has placed on the market the new Bryant flush tumbler switches, No. 3951 series, having the "on" and "off" indications on the brown composition handles. The switches can be furnished with "Glo-Guide" transparent "Templus" luminous handles, or with luminous tip on the handles, or black handles may be obtained.

THE LAPP INSULATOR COMPANY, INC., LeRoy, N. Y., announces the appointment of Elgin B. Robertson as its representative for the state of Texas, with headquarters at 711 Southwestern Life Building, Dallas.

THE GENERAL ELECTRIC SUPPLY COMPANY, wholesaler, has leased a five-story building at 733 Tchoupitoulas Street, New Orleans, La., for a period of ten years. The new quarters has a floor space of 54,000 sq.ft.

THE OKONITE-CALLENDER CABLE COMPANY, New York, will open an office on July 2 at the Statler Office Building, 20 Providence Street, Boston, under the direction of Lewis G. Martin, vice-president.

THE ADAPTI COMPANY, 2996 East 72d Street, Cleveland, has placed on the market a new type of self-aligning suspension fitting for fixture conduit work.

THE HURLEY MACHINE COMPANY, 22d Street and 54th Avenue, Chicago, manufacturer of "Thor" washing machines, ironers, etc., announces a new type portable speed iron. The new ironer is made in two models, known as No. 10 and No. 0. The No. 0 will sell at retail east of the Rockies for $49.50 and the No. 10 for $79.50.

THE CHISHOLM-MOORE MANUFACTURING COMPANY, Cleveland, manufacturer of chain hoists and trolleys, traveling cranes and electric hoists, announces that it will hereafter be known as the Chisholm-Moore Hoist Corporation (division of the Columbus McKinnon Chain Company).

THE GENERAL ELECTRIC COMPANY, merchandise department, Bridgeport, Conn., announces that, in addition to its present vacuum cleaner, it is now marketing a smaller vacuum cleaner known as the G.E. Junior. The reduction in size is said to adapt it particularly for use in apartment houses and small homes. The Junior cleaner will be sold for $24.50 without attachments, which may be purchased separately for $10 and $6.50. Both sets of attachments are interchangeable with either cleaner.

Equipment Orders Placed for Saluda River Project

Equipment for the generating station of the Saluda River hydro-electric development, 10 miles west of Columbia, S. C., has been ordered by the Lexington Water Power Company, a subsidiary of the General Gas & Electric Corporation. The transformers will be built by the General Electric Company, the generators by the Westinghouse Electric & Manufacturing Company and the turbines and main pivot valves by the S. Morgan Smith Company, York, Pa.

The power plant will have an initial installation of 200,000 hp. and an ultimate capacity of at least 300,000 hp. Four turbines will be installed immediately, each having a capacity of 50,000 hp. The ultimate installation will be six of these units or a total capacity of 195,000 kw.

THE HANSON-VAN WINKLE-MUNNING COMPANY, Mattawan, N. J., manufacturer of electroplating and polishing equipment and supplies, announces that George Smith has been appointed vice-president in charge of the activities in the Central and Western states. Mr. Smith has been with Roth Brothers & Company in Chicago as vice-president and general manager since 1923.

THE GENERAL ELECTRIC COMPANY, merchandise department, Bridgeport, Conn., announces the new triple-pole polarity plugs and receptacles. These plugs and receptacles are designed for use with electric ranges and make it possible to disconnect and plug in the range in a new place as simply as an electric iron.

THE OLIVER IRON & STEEL CORPORATION, Pittsburgh, announces that O. H. Davidson, president of the O. H. Davidson Equipment Company, 130 West Fourteenth Avenue, Denver, Colo., has been appointed district manager in the Rocky Mountain territory. Mr. Davidson will have charge of the pole line material and the bolt, nut and rivet departments.

THE HOLOPHANE COMPANY, INC., 342 Madison Avenue, New York City, has placed on the market the Holophane widespread lighting unit for outdoor use. As its name implies, the unit is so designed that the light rays are directed to give a wide spread. The company also announces another new lighting unit, the Holophane multiple-control lens system for the lighting of hospital operating rooms.

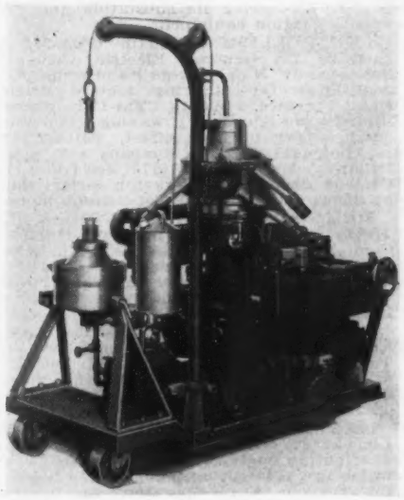
THE WEIR ELECTRIC APPLIANCE COMPANY, 903 Ray Building, Oakland, Calif., announces a new line of electric heaters, including a heavy-duty heater, a flush type bathroom heater, an andiron heater, a fireplace log and a portable heater.

THE O. C. WHITE COMPANY, Worcester, Mass., manufacturer of adjustable electric light fixtures, announces the "White" daylight reflectors with special lenses.

New Equipment Available

Portable Oil Purifier

A number of very important advantages, including an increase in capacity of approximately one-third, are claimed by the De Laval Separator Company, New York, for its No. 700 portable insulating oil purifier. The outfit consists essentially of an all-steel truck on which is mounted the following units: The oil purifier unit, having a maximum capacity of 800 gal. per hour; a 12-in. blotter press, three 6-kw. immersion electric heaters, two rotary pumps with motor, thermostatic heater cutout, bowl-cleaning vise and hoist, thermometer and clean oil collecting tank with a float



Portable type insulating oil purifier

valve to regulate the flow of oil through the machine.

The outfit is piped to give four combinations of operation. The construction and operation of the centrifugal oil purifier are essentially the same as is found in other De Laval machines. The purifier also is equipped with a friction clutch pulley which enables the bowl, or rotating member, to be automatically brought up to speed without attention and without overloading. The purifier also can be furnished as a non-aerating conservator type unit for use in connection with conservator transformers or as a stationary unit.

Expansion Anchors

The line of Kearney "Hi-Tension" four-in-one expansion anchors which the manufacturer claims are suitable for use in any kind of hard soil, at any angle, to any depth and in any location, has been placed on the market by the James R. Kearney Corporation, St. Louis. They are manufactured in four sizes—6 in., 7 in., 8 in. and 10 in. The anchors are made of certified malleable iron and are guaranteed against breakage. They can be used as an expanding anchor, as a plate anchor, as a cone anchor, or as a metal slug anchor. They expand to 2½ times their rated size.

This anchor is said to give a compression of earth when expanded. The blades are pitched slightly downward. When once expanded, the anchor becomes permanently locked in its open position. It is recommended that the anchor be set horizontal as in this manner it pulls against the same strata of undisturbed earth. According to the manufacturer, the 6-in. anchor is recommended for a holding power of 12,000 lb. in hard pan, 7-in. anchor for 16,000 lb., the 8-in. anchor for 20,000 lb. and the 10-in. anchor for 30,000 lb.

Reversing Starter

A line of automatic, alternating-current reversing starters, rated at 15 amp. for all voltages, has been placed on the market by the Industrial Controller Company, Milwaukee. The starters provide remote control, low voltage and overload protection and are arranged for either two or three wire control. The class 8732 starter has two mechanically interlocked contactors and is provided with thermal overload relays. The class 8712 is of similar construction and is furnished without overload relays. The mechanism is entirely inclosed in a steel cabinet which has a baked enamel finish.

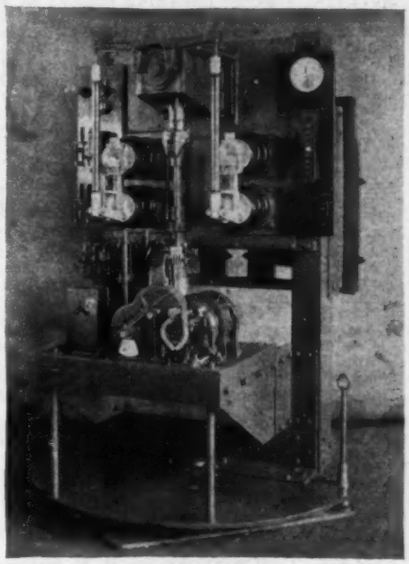
Disconnecting Switch with Full Floating Contact

A disconnecting switch with a full floating contact which has a large capacity for misalignment has been placed on the market by the Railway & Industrial Engineering Company, Greensburg, Pa. The contact consists of two copper blocks, an upper and lower, connected electrically by a laminated flexible conductor and mechanically by a parallelogram link arrangement which permits a total of 1½ in. sidewise displacement. The linkage has sufficient clearance to allow an ample angular movement to compensate for blade or contact misalignment. The upper block has ordinary knife-blade contacts with guides for the blade to relieve the contact clips from all pressure.

OIL TEMPERING BATHS.—The redesign of its line of oil tempering baths without any change in dimensions has been announced by the General Electric Company. These units, electrically heated, are for tempering carbon steels, and the redesign is said to simplify the periodic cleaning of the heating units and prolongs the life. In the new design the heating units are fastened to the flange on the tank. To remove a burned-out unit or to remove units for cleaning purposes it is only necessary to remove six screws holding the protective apron in place. After removing the protective apron the units can be taken out one at a time. The new units have been equipped with a sealed terminal instead of one of the open porcelain type.

Transformer Load Ratio Control Equipment

The full-sized model of the latest type of General Electric transformer load ratio control equipment shown in the illustration also was exhibited at the Atlantic City convention of the National Electric Light Association and was connected to the local supply circuit and



Mechanism controlling transformer ratio

shown in actual operation. The equipment comprised two ratio adjusters connected electrically in parallel to one set of transformer taps. A heavily built intermittent gear accomplishes the resetting of one ratio adjuster at a time. Adjusters and gear are located within the transformer. A set of two cam-operated, oil-immersed external contactors breaks and makes the current in the two ratio adjuster branch circuits when taps are to be changed.

A compact motor-driven mechanism, located under the contactor tank, accomplishes the proper sequence of operations within two seconds. The entire apparatus is remotely controlled from the station switchboard. A remote position indicator with a numbered lamp for each position informs the station operator on which tap the transformer stands. The model contained all of the parts in full size. Taps were actually changed on a small 200-watt transformer, with a 200-watt carbon filament lamp as load. A voltmeter connected in parallel with this lamp indicated visually when changes were made in the transformer secondary voltage.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 12, 1928)

1,673,746. SWITCH CONTACT; C. T. Hanna, Rugby, England. App. filed June 3, 1923. Drum type using pivoted fingers.

1,673,748. SWITCHING APPARATUS; H. J. H. Huber, Schenectady, N. Y. App. filed Jan. 29, 1923.

1,673,752. NON-METALLIC SHEATHED MULTIPLE-CONDUCTOR CABLE; E. H. Lewis of Bridgeport, and C. O. Hull, New Bridgeport, Conn. App. filed June 28, 1927.

1,673,756. ELECTRIC ATTACHMENT PLUG CAP; L. H. Moulthrop, South Norwalk, Conn. App. filed May 11, 1925.

(Issued June 19, 1928)

1,673,790. MAGNETIC MATERIAL, PROCESS OF PRODUCING IT, AND ELECTROMAGNETIC DEVICE INCORPORATING SUCH MATERIAL; A. F. Bandur, Berwyn, Ill. App. filed Dec. 13, 1924.

1,673,819. CIRCUIT-BREAKING RELAY; N. R. Haas, Dayton, Ohio. App. filed April 12, 1922. Employed in automotive lighting and ignition systems.

1,673,835. SEPARATOR; H. B. Lindley, Hattiesburg, Miss. App. filed April 10, 1922.

1,673,847. DRIVING MECHANISM FOR TALKING MACHINES AND THE LIKE; W. G. Shelton, New York, N. Y. App. filed April 20, 1920.

1,673,868. EXPULSION FUSE; F. Farrell, Chicago, Ill. App. filed March 26, 1925.

1,673,893. ELECTRIC SWITCH; J. B. Tucker, Birmingham, England. App. filed Aug. 5, 1926. Flush switch, toggle type.

1,673,896. CENTRIFUGAL SWITCH; E. C. Ballman, St. Louis, Mo. App. filed Oct. 8, 1924. As used on electric motors for changing the winding connections as the speed changes.

1,673,919. METHOD OF MEASURING VOLT AMPERES IN AN ALTERNATING-CURRENT CIRCUIT; L. A. Paine, Toronto, Ont., Can. App. filed Aug. 27, 1921.

1,673,946. GROUND CONNECTION; W. P. Marr, Toronto, Ont., Can. App. filed Oct. 23, 1924.

1,674,017. COMBINATION ELECTRIC HEATER AND FAN; J. E. Marsden, Philadelphia, Pa. App. filed March 15, 1926.

1,674,050. MAGNETO; T. G. Louis, Springfield, Mass. App. filed Sept. 3, 1926.

1,674,051. CONTROL FOR ELECTRICALLY-OPERATED HEAT-GENERATING SYSTEMS; I. E. McCabe, Chicago, Ill. App. filed Feb. 1, 1926.

1,674,070. CABLE STRUCTURE; D. M. Simons, Osborne, Pa. App. filed April 29, 1927. Of lead-sheathed cables.

1,674,078. THERMOSTATICALLY-ACTUATED SWITCH; G. O. Wilms, Milwaukee, Wis. App. filed July 6, 1925.

1,674,094. ARMATURE-ACTUATING MECHANISM; P. Brown, Springfield, Mass. App. filed March 24, 1926. For actuating the armature of a magneto.

1,674,109. METHOD OF ELECTRIC WELDING; B. Grob, West Allis, Wis. App. filed May 6, 1927. Butt welding of heavy plates, heavy pipe sections and the like.

1,674,126. REMOTE CONTROL SYSTEM; R. G. Richardson, Chicago, and J. I. Bellamy, Brookfield, Ill. App. filed April 30, 1923. As used by a despatcher to control circuit breakers and the like.

1,674,127. REMOTE CONTROL SYSTEM; J. I. Bellamy, Chicago, Ill. App. filed May 17, 1923. As used by a despatcher to control circuit breakers.

1,674,151. THERMOSTATIC ELECTRIC SWITCH; J. W. Anderson, Hamilton, Ont., Can. App. filed April 14, 1926. For controlling the driving motor of a refrigerator.

1,674,239. ELECTRIC POWER REEL; B. G. Bird and H. D. Wright, McComas, W. Va. App. filed Feb. 12, 1925. For mining machinery.

1,674,242. DEHYDRATOR HAVING ROTATABLE ELECTRODE; W. O. Eddy, Long Beach, Calif. App. filed Nov. 29, 1926.

1,674,245. ELECTRIC BELL; A. C. Gaynor and E. G. Gaynor, Stratford, Conn. App. filed Oct. 9, 1923.

1,674,246. ELECTRIC CONNECTER; A. C. Gaynor, Stratford, and E. G. Gaynor, Fairfield, Conn. App. filed Oct. 6, 1926. Attachment plug cap.

1,674,253. CONNECTER; E. N. Lightfoot, New York, N. Y. App. filed Sept. 27, 1920. Consisting of a tubular casing.

1,674,258. INSULATED SCREW; H. F. Obergfell, River Forest, and J. Erickson, Chicago, Ill. App. filed June 24, 1925.

1,674,275. CONTACT MECHANISM FOR TOY RAILROADS; E. Caruso, Irvington, N. J. App. filed May 22, 1925.

1,674,284. SEPARATOR FOR THE PLATES OF STORAGE CELLS; W. L. Gill, Oakland, and J. O. Mudgett and A. B. Bennett, San Jose, Calif. App. filed Jan. 27, 1926.

1,674,297. FREQUENCY CONVERTER; W. T. Powell, Rochester, N. Y. App. filed March 6, 1923.

1,674,298. ALTERNATING-CURRENT RECTIFIER; W. T. Powell, Rochester, N. Y. App. filed July 28, 1925.

1,674,324. ELECTRIC-LIGHT SOCKET; J. Figueira, New York, N. Y. App. filed July 18, 1927. Pull-chain socket.

1,674,327. ELECTRIC SPOT WELDER; V. F. Greaves, Oakland, Calif. App. filed Jan. 31, 1927.

1,674,334. CONTROL FOR ELECTRIC WATER HEATERS; G. A. E. Jones, West Cheshire, Conn. App. filed May 21, 1924.

1,674,339. FUSE-CONTROLLED SWITCH; E. W. Nass, New Orleans, La. App. filed July 5, 1927.

1,674,364. ELECTRODE BOX; H. B. Hartman, Buffalo, N. Y. App. filed April 18, 1927. Apparatus for purifying water by electrolysis.

1,674,369. ELECTRIC LIQUID HEATER; T. H. McQuinn, Preston, Victoria, Australia. App. filed Oct. 4, 1926.

1,674,383. ELECTRIC MOTOR; J. D. Willis, Oakland, Calif. App. filed Aug. 11, 1926.

1,674,441. ELECTRICAL CONNECTER; B. P. McKinley, Flushing, N. Y. App. filed Aug. 4, 1924. Adapted to receive plug contact members of a heating device or the like.

1,674,444. SAFETY DEVICE FOR ELECTRICAL APPARATUS; H. Michulitz, Berlin, Germany. App. filed Feb. 10, 1927. For encased oil immersed apparatus such as transformers, reactors and the like.

1,674,451. ELECTRIC POWER DEMAND CONTROL SYSTEM; J. F. Schrumm, Waterbury, Conn. App. filed Jan. 26, 1927.

1,674,477. ELECTRIC APPARATUS; K. H. May, Berlin, Germany. App. filed Aug. 9, 1926. For electrically determining a negative phase sequence component of a circuit current or potential whereby a condition of phase unbalance may be determined.

1,674,482. ELECTRIC MEASURING INSTRUMENT; T. A. Rich, East Lynn, Mass. App. filed April 2, 1927. Frequency responsive device of high sensitiveness such as will indicate minute variations in frequency with a comparatively large scale deflection.

1,674,488. ELECTRIC HEATING UNIT; B. G. Tang, Schenectady, N. Y. App. filed Dec. 20, 1922.

1,674,489. AUTOMATIC SWITCH; H. W. Vickery, Lynn, Mass. App. filed Nov. 28, 1924. Automatic two-way fluid contact switch.

1,674,497. ELECTROLYTIC CELL; H. G. Brinton, Pittsfield, Mass. App. filed Nov. 10, 1924. For use as surge absorbers on direct current circuits.

1,674,516. MOTOR-DRIVEN CYLINDER; F. Lunz, New York, N. Y. App. filed Feb. 19, 1927. In the form of pulleys, rolls, drums, sheaves, etc.

1,674,545. CIRCUIT CLOSER FOR ANEMOMETERS; C. H. Duffy, Washington, D. C. App. filed Sept. 22, 1920.

1,674,570. ALARM SWITCH AND DOOR LOCK; A. Re, New York, N. Y. App. filed March 7, 1927.

1,674,576. WELDING ELECTRODE; A. P. Strohmenger, London, England. App. filed June 17, 1926.

1,674,591. HEATER FOR HAIR-WAVING OUTFITS; G. Decker, Cleveland, Ohio. App. filed May 17, 1927.

1,674,594. SEPARATOR RETAINER FOR STORAGE BATTERIES; H. J. Hampton, Manchester, England. App. filed July 10, 1924.

1,674,601. MERCURY SWITCH; I. E. McCabe and R. W. Armstrong, Chicago, Ill. App. filed Oct. 22, 1924.

1,674,604. ELECTRIC CONTACT DEVICE; A. S. Moon, San Francisco, Calif. App. filed June 24, 1927. For flashing a sign.

1,674,609. HYDRO-ELECTRIC INSTALLATION; A. Pfau, Milwaukee, Wis. App. filed Sept. 24, 1924. Where the machine is operative under a widely varying head.

(Issued June 26, 1928)

17,009 (reissue). ELECTRIC SWITCH; J. Lofgren, Chicago, Ill. App. filed Nov. 2, 1925. For rough usage as on locomotives.

1,674,633. FUSE; R. E. Bowen, Indianapolis, Ind. App. filed June 7, 1926. Renewable.

1,674,645. RECTIFIER; W. G. Hettich, Chicago, Ill. App. filed Jan. 30, 1926. Mechanical rectifier.

1,674,653. ELECTRIC SOLDERING IRON; N. E. Mann, New Britain, and A. M. Young, Meriden, Conn. App. filed May 7, 1926.

1,674,656. FUSE; P. A. Newman, Philadelphia, Pa. App. filed Oct. 30, 1924. Which operates because of heat produced within the fusible element and of heat absorbed by the fusible element.

New Trade Literature

CENTRIFUGAL PUMPS—The Ingersoll-Rand Company, 11 Broadway, New York City, has issued a catalog covering the "Cameron" multi-stage centrifugal pumps for boiler feeding, hydraulic services in steel mills, mine drainage, pipe lines, etc. The catalog describes the application, operation and construction of the pumps and contains a number of illustrations.

LIGHTING UNITS.—The General Electric Company, Schenectady, N. Y., has issued bulletins GEA-469B and GEA-728A covering its "Novalux" cutouts for ornamental street-lighting units and the "Novalux" lantern units. The company also is distributing bulletin GEA-907A describing the 24-in. aviation beacons and bulletin GEA-983 covering the multiple circuit intermediate field boundary light.

LIGHTING FIXTURES.—The O. C. White Company, 15 Hermon Street, Worchester, Mass., is distributing a booklet covering the "White" adjustable and portable fixtures.

SUBSTATION AND GENERATING STATION EQUIPMENT.—The Railway & Industrial Engineering Company, Greensburg, Pa., has issued its general bulletin No. 1001 covering its substation and generating station equipment.

CONTROLLERS.—Bulletin GEA-962 issued by the General Electric Company, Schenectady, N. Y., covers its printing press controllers for slip-ring motors driving small presses, folders, flat-bed presses, lithographic presses, waxing machines, small rotary presses, offset, cutting and creasing presses. The company also is distributing bulletin GEA-973 describing its CR3100 drum controllers for series, shunt or compound wound direct-current motors.

REMOTE CONTROL SWITCHES.—The Hart Manufacturing Company Hartford, Conn., has issued bulletin No. 10 in which it describes and illustrates the various types of "Diamond H" remote control switches with wiring diagrams and types of application.

ELECTRIC APPLIANCES.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, is distributing a catalog supplement No. H523, showing 26 new "Hotpoint" items added since the last catalog was printed.

ARC WELDING EQUIPMENT.—The Lincoln Electric Company, Cleveland, is distributing engineering bulletin No. 206 in which are pointed out comparisons between the Lincoln single-operator, variable-voltage welder and the constant-potential, multiple-operator type of welder.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Dresden, Germany (No. 32,014), for electric cloth-cutting machines.

An agency is desired in Singapore, Straits Settlements (No. 32,077), for electro dental equipment.

Purchase is desired in Zeuleroda, Germany (No. 32,096), of floor polishers.

Purchase and agency are desired in Santos, Brazil (No. 32,086), for electric labor-saving devices.

An agency is desired in Melbourne, Australia (No. 32,012), for novelty electrical appliances.

An agency is desired in Dublin, Ireland (No. 32,011), for electric household refrigerators.

An agency is desired in Berlin, Germany (No. 32,013), for electric household refrigerators.

Purchase is desired in Leipzig, Germany (No. 32,009), of electric household refrigerators and units.

An agency is desired in Munich, Germany (No. 32,015), for electric household refrigerators and units.

A project is under way for a hydro-electric plant in Brazil, to supply light and power to the city of Santa Rita do Paranahyba in the state of Goyaz. (E. Victor Saadeh, Rio de Janeiro, Brazil, Clerk.)